

Mechanical Operated Automation System for Box Feeding & Stamping

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Abstract— This project objective is to know the actual working of the Automation system. This is a mechanism used for automatically pushing up a box and punches a stamp on it. In this working model, we have made the actual working or simulation of automation system so that it is easy to understand. Our main goal is to make a study model of punching, stamping and power transmission in automation system. This prototype helps to understand the actual working of model. With actual working of it only placing all the component in its proper positioning and simplifying the working. It is exactly similar to that of the actual automation system used in industries. This prototype minimizes the time required for the stamping on box or packing. It saves the time and human effort for stamping operation.

Key words: Automation System, Stamping machine, Feeding System, Geneva Mechanism, Quick Return Mechanism

I. INTRODUCTION

A. System Description

Now days, there is lot of competition in the market. So there is need of developing a new method or process for effective manufacturing. That process or methods should fulfill the requirement about accuracy Productivity etc. It is necessary to reduce the total matching time. There are various ways by which the total machining time can be effectively minimized. There are various time consuming steps or sub process, which can be, minimize by various methods. In mass production the time criteria is very important. Within small time limit, a single unit job has to be completed. For minimizing the job time, the handling of the job should be minimum. So that labor time considerably saved.

Form minimizing the handling time; we introduce the attachment for stamping machine for the operation. Suppose for one job B, there are number of sequential operations and that can be effectively perform by one after another with greater accuracy & at faster rate. For stamping on table head is using hand process, but by this attachment, there is only first initial making is required and the stamping operation is done automatically. This attachment is very useful for small-scale industry as well as workshop.

The Geneva mechanism plays important role to achieve desired goal. It converts the rotary motion into the intermittent motion which helps to slide a box in specified distance. Our main motto is to achieve the desired time management and punch stamp on the box with higher production rate. The Geneva drive is a gear mechanism that translates a continuous rotation into an intermittent rotary motion. The rotating drive wheel has a pin that reaches into a slot of the driven wheel advancing it by one step. The

drive wheel also has a raised circular blocking disc that locks the driven wheel in position between steps. A quick return mechanism is an apparatus that converts circular motion (rotating motion following a circular path) into reciprocating motion (repetitive back-and-forth linear motion) in presses and shaping machines, which are utilized to shape stocks of metal into flat surfaces, throughout mechanical engineering. The quick return mechanism is the foundation behind the energy of these machines. This principle motivated us to use quick return mechanism for feeding the box. The return stroke of the mechanism take place within short time hence reduces the time lag. The concept has provided by the company and we have worked on that concept and designed the basic model first on pro- software.

B. System Specification

It is a primary object of the present invention to improve mechanically controlled systems for carrying out manufacturing processes. It is a further object of the present invention to provide a modular mechanical system that can be quickly converted to carry out different manufacturing procedures.

It is a still further object of the present invention to provide a modular mechanically controlled system that will accurately index boxes between work stations, and in addition cause a tool mounted in the work station to move into and out of a boxes positioned therein to carry out manufacturing steps. Another object of the present invention is to provide a simple mechanical drive unit that will control both the indexing of boxes between work stations as well as controlling the movement of production tools into and out of working contact with the boxes situated in a plurality of work stations.

C. Problem statement

Now a days at small as well as at large scale industries, for various operations like punching or stamping, cold automatic pressing, embossing, coining, take maximum jobs handling time, more man power requirement, more cost of attachment, high maintenance. For purpose of reducing the effort of man power, supply of electricity our design is used, to which one person can operate or handle all operation at same time.

D. Problem solution

For this problem our design project is used known as 'Mechanical Operated Automation System for box feeding and stamping'. In it we used the attachment for the stamping the boxes which are coming out to dispatch after packaging. Rotary indexing for stamping machine to overcome said errors in conventional machines. In this, we tried to implement Geneva wheel machine which gives higher accuracy.

E. Need of Project

- 1) Minimize the time required for stamping on box or packing.
- 2) Save the time and human effort for the stamping operation.

F. Objectives

We are expected to atomized the system and reduce the man power and time required for stamping operation by using mechanical operated automation system.

By modifying the stamping machine system, our motto is to reduce the human effort and reduce time cycle which helps to improve productive time and we also reduce the cost of machining system by avoiding the use of electronic devices in system.

II. LITERATURE REVIEW

A. Review of System

While working on this project we came across various components of mechanically operated automation system such as Main base, Geneva wheel, Geneva shaft, Crank shaft, crank, Synchronous motor, Spur gear, Bearing etc. And also we have studied the actual implementation of these components. While designing the model we came across various difficulties such as Geneva mechanism fitting. Initially we had collected all the components required for this automation system. We arranged all the components of mechanically operated automation system according to their function.

B. Literature Survey

There is a need of developing a new method or process for effective manufacturing. Automat is a device which can develop a effective manufacturing process. The model of automation system is basically small version of automation system is used in industries. Various Processes are performed on this automat or automation system.

The processes like stamping, punching, embossing etc. are performed in this automation system. Like other automation system, this system also undergoes or suffers from some issues, various mechanism like quick return mechanisms are used in our project The automation system comprises of power various mechanism, gear pairs ,various transmission system and the various gear transmission system.

III. WORKING PRINCIPLE

A. Principle

The basic principle that has taken into account for the attachment on stamping machine is “The conversion of rotary motion into intermittent motion”. The Geneva mechanism gives higher accuracy.

The indexing of the Geneva wheel are important because of the slot of the Geneva wheel will be responsible for the intermittent forward movement of conveyor and the time for this intermittent movement of conveyor belt.

B. Geneva Mechanism

There are many instances where it is necessary to convert continuous rotary motion into intermittent rotary motion. Such motion requirements generally exit in machine tools

where spindle, turret or worktable is to be indexed. The motion picture projector also demands intermittent motion to advance the film intermittently.

Geneva wheel or is one of the mechanism, which generate intermittent motion from the rotary motion of motor or prime mover. This mechanism was originally developed as check to prevent overweening of watches etc likewise there are lot of application of Geneva mechanism.

Figure shows Geneva wheel it is provided with four slot. The crank, which usually rotates at uniform velocity, carries a roller that engages with slots of Geneva wheel. Notice that the centerlines of the slots and cranks are manually operated particularly when the roller and slot engage or disengage during one rotation of crank.

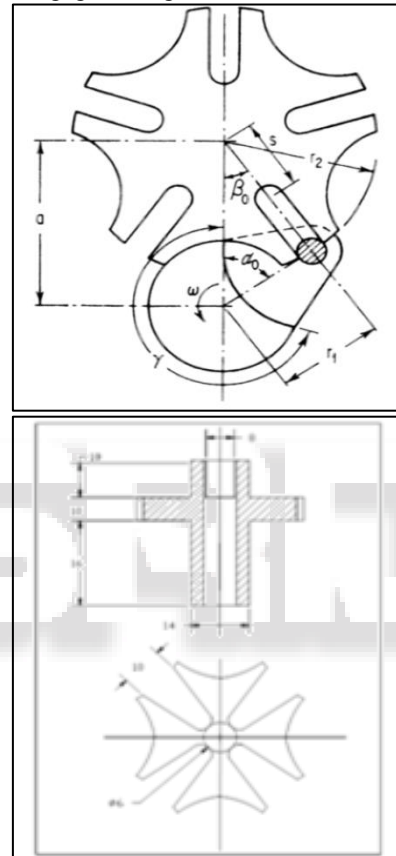


Fig. 1: Geneva Drive Mechanism

The Geneva wheel rotates the fractional part of rotation depending upon the number of slots. It is necessary to provide the locking device, which will not allow the Geneva wheel to rotate when the roller is not engagement. This locking device has a generally circular segment attached to the crank as shown in figure. These locking devices also position the Geneva wheel for correct engagement of the roller with the next slot. The Geneva wheel typically has three to eighteen slots.

C. Quick Return Mechanism

The Crank and lever reciprocating mechanism has been modified and used for constructing high velocity impacting press. The Crank and lever reciprocating mechanism is a mechanism able to transform circular movement into reciprocating movement. In this project we are using Spraying Pump as an application. The objective of the project is to verify that the motion does have a quick return stroke and a slow forward stroke. Additionally the increase in

efficiency of the system mechanism is also determined. It improves machining productivity.

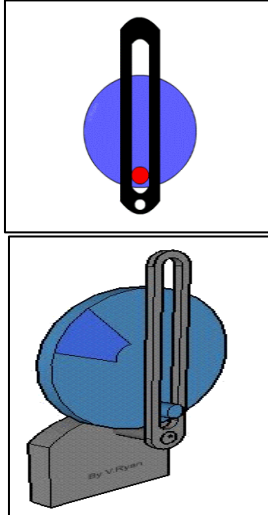


Fig. 2: Quick Return Crank Mechanism

A mechanism is mostly used in machine equipment; it generated from the linkage arrangement in such a passion by which desired output for the given input can derived, Quick return mechanism is six-bar mechanism in which time of return stroke is comparatively smaller than the time of cutting stroke so it is called quick return mechanism For complete understanding of any mechanism kinematic and dynamic analysis play significant role, kinematic analysis gives the position, velocity and acceleration of each link.

D. Punching Mechanism

Punching is a metal forming process that uses a punch press to force a tool, called a punch, through the workpiece to create a hole via shearing. Here we replaced a punching tool by stamp. The ram moves rapidly in downward direction toward the box which is placed right below the stamp and strike on the box to punch the stamp on it. The spring is attached to ram to arrive at original position.

E. Compound Gear Train

Compound gears are simply a chain of simple gear trains with the input of the second being the output of the first. A chain of two pairs is shown below. Gear B is the output of the first pair and gear C is the input of the second pair. Compound Gear train Gears B and C are locked to the same shaft and revolve at the same speed. For large velocities ratios, compound gear train arrangement is preferred.

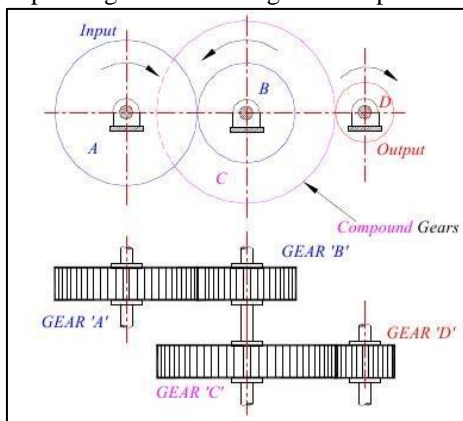


Fig. 3: Compound Gear Train.

F. Material Handling System by using Conveyor

Conveyor systems are the single most common piece of material handling equipment integrated into an engineered material handling system. Conveyor systems allow quick and efficient transportation for a wide variety of materials throughout a facility.

A conveyor system is a common piece of mechanical handling equipment that moves materials from one location to another.

Conveyors are especially useful in applications involving the transportation of heavy or bulky materials. Conveyor systems allow quick and efficient transportation for a wide variety of materials, which make them very popular in the material handling and packaging industries.



Fig. 4: Material handling conveyor

Many kinds of conveying systems are available, and are used according to the various needs of different industries. There are chain conveyors (floor and overhead) as well. Chain conveyors consist of enclosed tracks, I-Beam, towline, power & free, and hand pushed trolleys.

Many factors are important in the accurate selection of a conveyor system. It is important to know how the conveyor system will be used beforehand. Some individual areas that are helpful to consider are the required conveyor operations, such as transportation, accumulation and sorting, the material sizes, weights and shapes and where the loading and pickup points need to be.

IV. CONSTRUCTION

Frame forms the main part on which the whole mechanism is mounted. The frame is made up of mild steel. The synchronous motor is bolted to the plate which is attached to the main frame. This motor transmits power simultaneously to the Geneva wheel, stamping arm, and to quick return mechanism. The Geneva wheel transmits the power further to conveyor.

The motor having speed of 60 rpm is used. In order to obtain required speed to drive Geneva mechanism the gear are used. There are two type of gear used i.e. Metal gear and Nylon gear. Since the power requirement is not more we have used nylon gear to reduce cost and weight.

A. Parts of the project

- Main base
- Geneva wheel
- Geneva shaft
- Crank shaft
- Crank
- Movable table
- Synchronous motor
- Spur gear half

- Spur gear
- Bearing
- Reduction unit (gears)
- Bevel gear

The compound gear train is used to transmit the power to the quick return mechanism and conveyor shaft. The shaft having diameter 10 mm is used to mount the gear. For stamping mechanism the some teeth on gear are removed in order to assist the stamping process. The spring is used for proper stamping.

The quick return mechanisms consist of crank, crank shaft, push arm, slotted arm. Two type of bearing are used in this machine i.e. 6202 z (double shielded ball bearing having inner diameter 15 mm) and 6200z (double shielded ball bearing having inner diameter 10 mm). The conveyor made up of rubber having the length of 400 mm is used.

The crank is connected to the crankshaft which engages and disengages the Geneva wheel. The movable table and the Geneva wheel is mounted on the same shaft. The bevel gear is attached on second shaft, is attached to the frame. Stamping mechanism is welded on frame corner with connect to spring.

V. WORKING

The synchronous motor transmits power to the spur gear at 60 rpm. This gear is engaged with another gear having more number of teeth. These gears work as reduction unit. It reduces rpm of the motor from 60 to 13 rpm for Geneva mechanism. As a result the Geneva wheel moves with the speed of 13 rpm. From the Geneva drive the motion is transmitted to the conveyor shaft the spur gear having same number of teeth. The speed is reduced to the Geneva driven to 4 rpm.

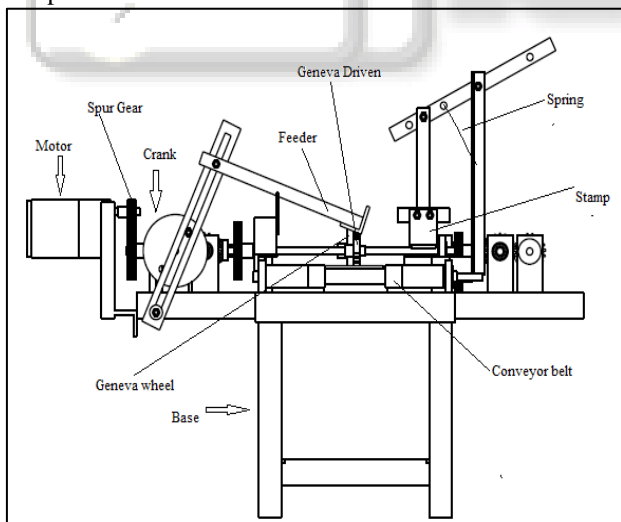


Fig. 5: Working of Mechanical operated automation system

This motion is transmitted to the punching mechanism through the bevel gear having 15 teeth. The motion is also transmitted to the quick return mechanism. In quick return mechanism the crank rotates at the 14 rpm which is same as that of the Geneva driver speed. In quick return mechanism the disk having diameter 105 mm is used. The one end of slotted arm is fixed to the frame and another end is attached to the push rod.

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Gears are a means of changing the rate of rotation of a machinery shaft. They can also change the direction of the axis of rotation and can change rotary motion to linear motion. Unfortunately, mechanical engineers sometimes shy away from the use of gears and rely on the advent of electronic controls and the availability of toothed belts, since robust gears for high-speed and/or high-power machinery are often very complex to design.

VI. ADVANTAGES AND LIMITATION

A. Advantages

- 1) It minimizes the jobs handling time of ideal time.
- 2) It minimizes the man power requirement.
Cost of this attachment is comparatively less.
- 3) It increases the efficiency of machine & productivity
- 4) It's maintenance is low
- 5) It's accuracy and repeatability is highly effective
- 6) It is effectively used on table packet or any cartons.

B. Limitation

- 1) The proper clamping arrangement should be required for clamping the job.
- 2) There is restriction in number of intermediate motion because number of motion depends upon number of slots on Geneva driver wheel, number of slots maximum can be possible eighteen.
- 3) Cannot be is used in large-scale industries.

VII. CONCLUSION

The project has been developed so as to, reduce the time required for stamping operation as well as reduce the man power, to increase the productivity and increase the accuracy of operation it will lead to rapid development of the small scale industry. By implementation of this project we have get our objective which were required by comparing with conventional stamping machines. We have implement the develop design of automated Gear system instead of using electronic devices in our project model.

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