



## Design and manufacturing of automatic bar feeding and clamping mechanism

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**ABSTRACT** - To reduce human effort for repetitive work of metal cutting as well as for providing a convenient fixture to support and hold the rod during cutting. The subject is undertaken as a part of project for B. E. Mechanical Engineering. The feeding and clamping of a bar is automated by using rollers and pneumatic cylinder. It has potential to reduce a huge amount of human efforts, increases efficiency and productivity. The primary concern of this system is to carry out two operations – Feeding and Clamping. For feeding of rod, a motor is used which is connected to a pulley which is further connected to a shorter pulley with the help of a belt. Pulley is connected to rollers, which starts moving along with it and thus, the rod is fed. Limit switch is used to stop the movement of rollers, as desired. Pneumatic cylinder is used for the clamping purpose, which also holds the rod tight for the purpose of reducing human effort for repetitive work. This is done by solenoid operated DCV. An Arduino module is used for automation and to control the various actions which are required for feeding and clamping of the bar. Time required is less when compared to manual cutting. This work provides the desired output.

**Keywords:** Pneumatic Vice, Motor, Rectangular Frame, Rollers, limit switch

### I. INTRODUCTION



**Figure 1: Original Machine W/O automatic bar mechanism**

In the recent period of automation where it essentially requires a mechanical power as a replacement of manual effort in all areas of automation. This project is aimed at achieving the accuracy while cutting MS bar of varying shapes and

sizes and for ease while feeding. In automation the advantage is it helps in saving labor; importantly, additionally it is used to save energy as well as materials and to improve accuracy, precision and quality. Conventionally bar is measured of required length as per the application manually using tape or any other measuring instrument. As per the requirement of the length of the bar it is cut after mounting the bar on the cutting machine. This is time consuming process and requires effort for loading and unloading the bar on the cutting machine. Also, the marking done by the operator helps in deciding the accuracy of the metal bar which may vary. Recently for the use in a floor different types of electrically operated powerhacksaw machines of various industries are available. These machines

are so precise that they can cut metal bars made up of different materials with minimum time, but they have one major disadvantage that they are not able to cut at faster rate as well as these require manual intervention for every operation of bar to be cut and also these machines are of high cost. Thus, a system has to be created which handles the operation of bar cutting efficiently such a way that it requires low mechanical effort to carry out the bar feeding as well as cutting operation automatically. To overcome these advantages, this project involves designing and manufacturing of automatic bar feeding and clamping mechanism, which not only saves the time but is also accurate as it is computerized.

**1.1. Problem Statement**  
Design and manufacturing of automatic Feeding and Clamping mechanism incorporating the use of Pneumatic Vice for clamping purpose pair of rollers for feeding which are driven by a D.C. motor.

## II. DESIGN WORK CARRIED OUT

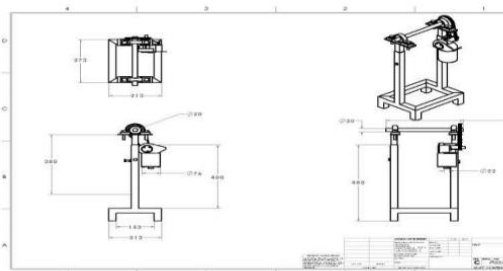


Figure 2: SolidWorks Drawing of the Feeding Mechanism

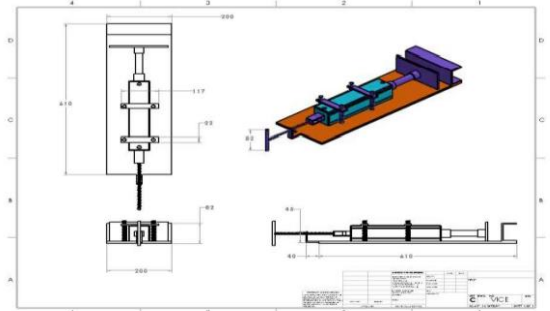


Figure 3: SolidWorks Drawing of the Clamping Mechanism

## III. WORKING METHODOLOGY

**3.1. Principle** The automatic bar feeding and clamping mechanism is an Arduino controlled metal cutting machine tool designed to feed and clamp the metal bar in a continuous manner. With the help of belt drive, the metal bar moves over the roller till it comes in contact with the limit switch which is placed as per the required length of the bar. Upon touching the limit switch, Arduino provides signal to motor to come at rest and simultaneously clamps the work piece. After cutting of the metal bar as soon as the contact between bar and limit switch is over the clamp return to the original position and motor will operate again.

## IV. COMPONENTS

**4.1. Components Used for Feeding Purpose**

**4.1.1. Rollers** Rollers are used for the purpose of moving the metal bar so that bar can be moved forward with less power achieving the friction less movement



Figure 4: Rollers for support of bar feeding.

4.1.2. P.M.D.C. Motor Motors take electrical energy and produce mechanical energy. PMDC is a compact size and economically priced rugged right angle worm gear motor. We are making the use of motor for moving the rollers in forward direction. The rod will further move on rollers and strike the limit switch and indeed it will give signal to stop the motor and the cutting action will take place.



Figure 5: PMDC Motor 25 RPM



Figure 6: Frame for holding Support Rollers



Figure 7: Battery pack for Electrical Units



Figure 8: Pneumatic Vice



Figure 9: Pneumatic Vice as placed in machine

Pneumatic cylinder is a device which uses compressed air/gas supplied by the compressor to produce linear reciprocating motion which generates force to clamp the work piece/component. Pneumatic Cylinder with stroke length 110mm is used. It is readily available in market. Cylinder is further connected to the movable vice. A scale is attached to the base which is connected to the limit switch. Operator can vary the length of bar to be cut according to his need



Figure 10: Arduino Uno R3 Module

## V. MACHINING OPERATIONS CARRIED OUT

**Abrasive Cutting machine** An abrasive saw which is however known as a cut-off saw or metal chop saw, is used to cut hard materials such as metals which functions as a power tool. An abrasive disc is used for the cutting action which is similar to a thin grinding wheel.



Figure 11: Abrasive Saw



Grinding is truly a metal cutting process which is a subset of cutting. Grinding practice is carried out at a very large scale for manufacturing and tool making. Accurate dimensions and smooth finishes can be obtained and yet it can wear out workpiece in production of large volumes of metal quite rapidly.



Figure 13: Grinding Operation in action

## VI. PERFORMANCE ANALYSIS

When manually operated power hacksaw machine was automated, improvement in the overall performance of the machine was observed. Improvements in the major parameters are explained as follows: The efficiency of the operation is increased.

- The rate of production is relatively increased.
- Increase in accuracy and quality of the component. Reduced human efforts, work load and labor cost.
- The process is controlled by arduino which enables to run the operation in a continuous manner. Human intervention is minimized.
- Time required to produce large number of jobs is minimized.

## VII. RESULT

This works provides an alternative to the existing bar cutting machine, it provides automatic bar feeding into the cutting apparatus and clamping, eliminates power fluctuation and increase the work efficiency. Time consumption is less when compared to manual cutting, this work provides desired output. Thus, a system needs to be developed which can handle the operation of bar cutting effectively in such a way that it requires



minimum mechanical effort and carry out the bar feeding as well cutting operation automatically. The Automatic Hacksaw machine can be used for different kind of industrial purpose that involve a bulk of shafts that have to be cut frequently. The range of size of size of work pieces that can be cut can be varied by changing the blade size. VIII.

## CONCLUSION

The design and manufacturing of automatic bar feeding and clamping mechanism will be very useful for small scale industries, workshops, etc. We have used components for automation of this mechanism such as Pneumatic clamp, Arduino, PMDC motor, Limit switch, etc. The main aim of this machine is to reduce the human effort, time required for cutting, increase accuracy and neglect the time for measuring the workpiece. This aim is achieved by bringing the automation in the power hack saw machine. There are some machines which has been already designed, but we have introduced some new components and we also have different design which increases the efficiency of the process

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