

# AUTOMATIC BAR FEEDING MECHANISM FOR PIPE CUTTING MACHINE

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## ABSTRACT

*To reduce human effort for repetitive work of cutter pieces of pipes as well as providing a convenient fixture to support and hold the pipes/rods during cutting. The subject is undertaken as a part of B.E mechanical project. It can be termed as smart machine.*

*There are many industrial applications where round bar or square bars are required to be operated on different machines to make machine components such as Shafts, Bolts, Screws, etc. This needs more and more number of pieces to be cut for mass production of those components. The bar feeding mechanism is a metal cutting machine tool designed to feed the metal. The machine is exclusively intended for the mass production and they represent faster and more efficient way to feed the metal.*

*The clamping arrangement can be varied according to need of operations suitable. The overall system is compact in size, light weight, modular and flexible to be used in small works jobs who need batch production. The setup overall configuration can be adopted by a semi-skilled worker easily and can vary the operations by making certain small changes. The system even has the potential to add up a PLC system to control its overall working with ease and with less effort provided. This system has the potential to adopt higher level of automation if desired in future.*

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**I INTRODUCTION**

This is an era of automation where it is broadly defined as replacement of manual effort by mechanical power in all degrees of automation. The operation remains an essential part of the system although with changing demands on physical input as the degree of mechanization is increased.

Degrees of automation are of two types, viz.

**1.1 Full automation.**

**1.2 Semi automation.**

In semi automation a combination of manual effort and mechanical power is required whereas in full automation human participation is very negligible Mechanical engineering without production and manufacturing is meaningless and inseparable. Production and manufacturing process deals with conversion of raw materials inputs to finished products as per required dimensions specifications and efficiently using recent technology.

The primary concern of this system is to carry out three operations Feeding, Clamping and cutting. The sequenced operations of the system must be precisely timed. The major work of this system is to slice out large number of jobs in rod or pipe form according to the batch production. The selection of cutter is based on the stress calculated considering the pipe or rod material. The material preferred in this system is a PVC (polyvinyl chloride) pipe for demonstration. But mild steel rods and pipes also be worked out by using different cutters specifications. The cutter to be used in the machine system has been considered by calculating the torque required for cutting PVC object by help of the design data available. With the help of this system the time required to slice the objects like the pipe or rod will be less the accuracy of slicing or cutting of the material will also be improved. The system can be handled by semi-skilled operators with ease. The layout of the machine is compact to be placed in a small workshops.

**II PROBLEM STATEMENT**

Design and develop a prototype model showing the concept of automated pipe cutting machine by using a mechanical mechanism incorporating the D.C. Motor for the required torque generation. Also fabricate the model of the same which will show automatic bar feeding.

### III OBJECTIVE

1. To meet the need of exploding population economic and effective control of machines.
2. The main theme of our project is used feed the raw material automatically to the machine.

### IV SCOPE

1. The maximum size of Round or Square bar can be increased by increasing the motor power and dimensions of different parts.
2. Automatic feeding mechanism for material can be introduced by using limit switches or sensors.
3. Automatic lifting up mechanism for frame when cutting operation is finished to introduce next portion of bar for cutting.

### V METHODOLOGY

Our project “automatic pipe cutting machine” Bar feeding mechanism is used to feed the raw material into the machine automatically when a set of operation is finished, it consist of two set of rollers one is ideal and another is drive roller, ideal roller are used to guide the job and feed roller has a driver from D.C motor ,this drive D.C motor has a timer, as per the time data motor will works, this timer can be adjusted as per ON time and OFF time delay as per length of material required.

### BLOCK DIAGRAM

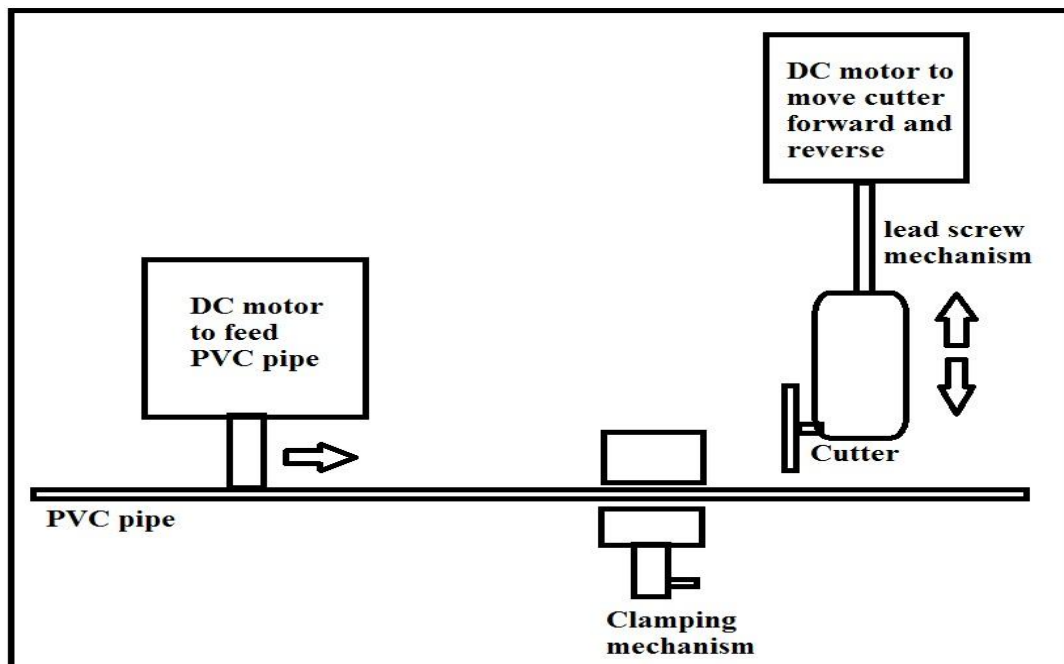


Fig1: Block Diagram

## **VI LITURATURE REVIEW**

The vast review of literature will help to understand the concepts, theorems and different factors affecting the performance of machine. R.S.Khurmi, J.K.Gupta in their book “Theory of machines” (Velocities in mechanisms) helps to find Velocity diagrams of slider crank mechanism.

### **Automatic stock bar feed mechanism for automatic screw machines**

#### **US 2300457 A by MARIOTTE**

This invention relates to stock bar feed mechanism for automatic machine tools or automatic screw machines, which mechanism embodies a plunger movable in a tube or cylinder to which a motive fluid, as air, is supplied to actuate the plunger to feed the stock bar against the stop of the machine tool or screw machine.

It has for its object a means for cutting oil the supply of motive fluid, or air, to the cylinder when the plunger has traveled a predetermined distance, this distance being that traversed by the plunger when a new stock bar is being inserted in the tube.

It further has for its object an interlocking means between the operating connections for the valve which controls the flow of air to the tube or cylinder, and a locking device which prevents displacement of the tube out of normal position, the locking device preventing opening of the valve, except when the tube is in its normal or operative position or permitting displacement of the tube out of normal position only when the valve is closed. The tube is shift able out of its normal or operative position to permit the insertion of a new stock bar in the tube. The invention is shown as applied to the machine of my pending application, Serial Number 353,545, filed August 21, 1940.

### **6.1 Theoretical Analysis of Multi-Way Power Hacksaw Machine**

**Prof. KshirsagarPrashant R. , RathodNayan J , RahatePrashant P , HalayePrashant P , SurveSachin S.**

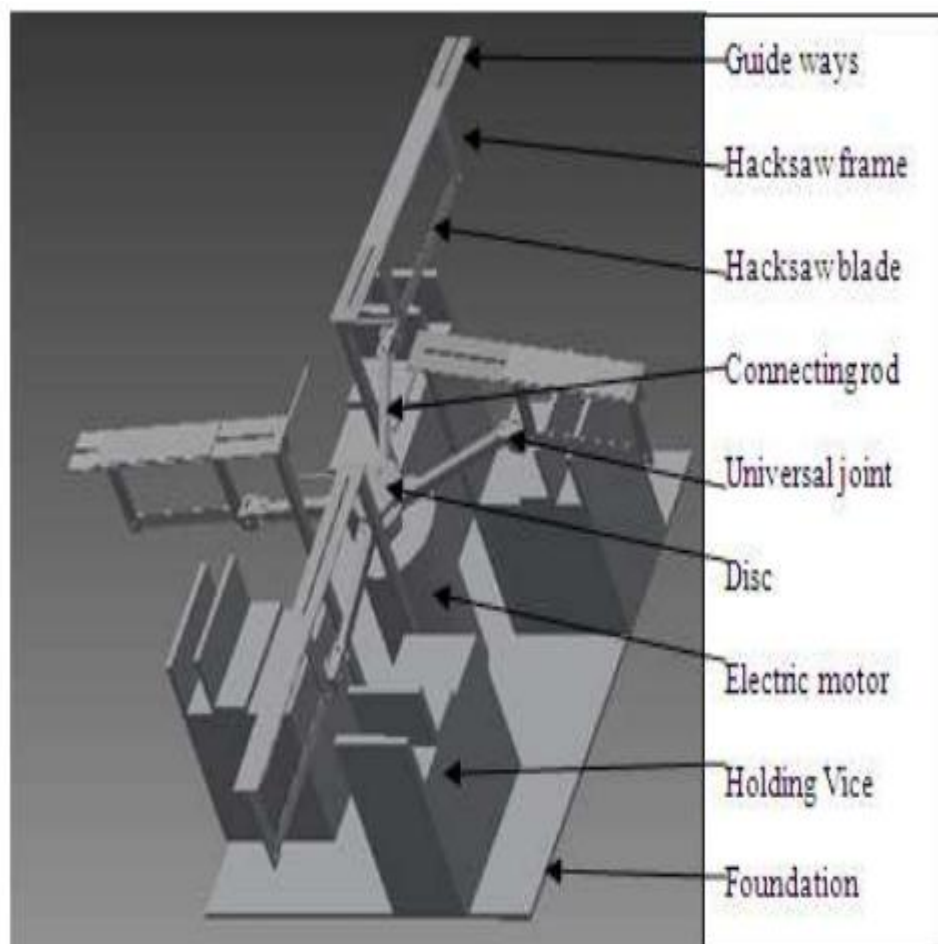
To achieve this goal the Multi-way power hacksaw machine is developed. This paper proposes the model of multi-way hacksaw machine which is able to cut four pieces simultaneously without any jerk and minimum vibrations. The model implies conversion of rotary motion into the reciprocating motion for proper working of hacksaw. This model overcomes the limitations of conventional hacksaw machines which can cut single piece at a time. It is able to cut metal bars of different materials at same time and will be helpful in many industries due its compatibility, reliability and efficiency.

In present condition many electrically operated power hacksaw machines of different companies with different specifications are available for the use in shop floor. These machines are so precise that they can cut metal bars with minimum time made up of different materials but they have one and major disadvantage that those are able to cut single piece of bar at a time. For industries to achieve the mass production, it is necessary to cut metal bars with high rate. So it is impossible to depend upon conventional single frame power hacksaw machines and need the improvement in technology and design of such machines. With the help of this multi-way power hacksaw machine the four metal bars can be cut simultaneously to get high speed cutting rate and to achieve

mass production for maximum profit in related companies. As this machine overcomes all the limitations and drawbacks of conventional hacksaw machines, it is also helpful for small scale industries due to its simple working and operating conditions along with its compatibility, efficiency and affordable price.

### **VII PROPOSED METHODOLOGY**

This project consists of single phase vertical electric motor rigidly placed at the center of metallic foundation provided. The shaft of motor rotates at 90- 100 rpm with the power 2HP. The circular disc is mounted on the shaft of motor with the help of key and key slot arrangement. The eccentric point on the plane of disc is provided such that the desired cutting stroke is achieved (around 4-5 inches). One end of each connecting rod is pivoted at this eccentric point by the use of suitable bearing. Another end of each rod is connected to the hacksaw blade fame with the help of universal joint to get vertical and horizontal Degree of Freedom of rotation for the proper cutting operation. The hacksaw frame slides on the guide ways provided. When motor is ON and disc starts rotating, due to the reciprocating motion of hacksaw frame the metal rod is cut which is firmly fixed in vise. The automatic feeding of coolant is provided to reduce heat generated due to friction which also avoids the jerk.



**Proposed model of Multi-way power hacksaw machine**

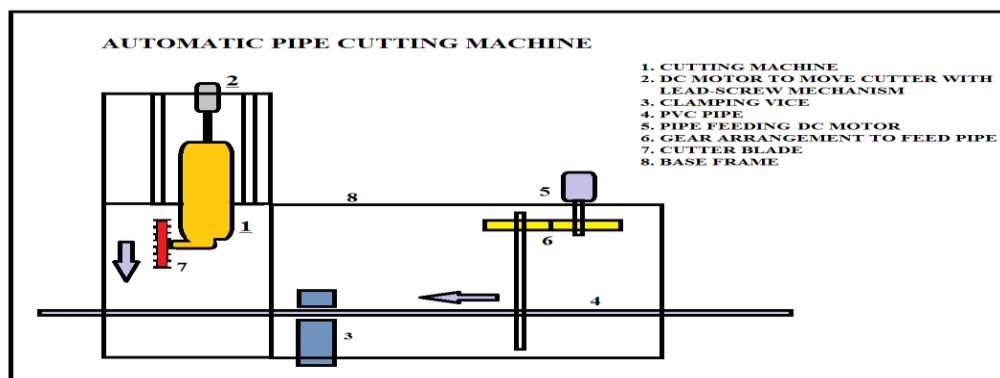
### 7.1 Design and Fabrication of Automated Hacksaw Machine

**D.V.Sabariananda, V.Siddhartha, B.SushilKrishnana,T.Mohanraj .**

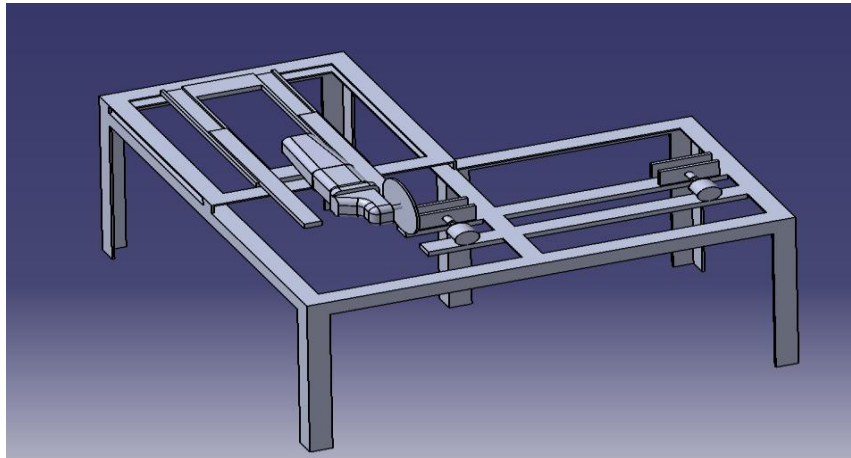
The objective of this work is to automate the conventional power hacksaw machine in order to achieve high productivity of work-pieces than the power hacksaw machine using Microcontroller. The automated machine acquires two inputs from the user namely the number of pieces to be cut and the length of each piece that is required to be cut. The inputs are given by the user with the help of a keypad and an LCD display, which will help the user to verify the data given by him. The operator need not measure the length of the work-piece that is to be cut and to load and unload the work-piece from the chuck each time after a piece has been cut. After acquiring the two inputs from the user, the machine automatically feeds the given length of work-piece in to a chuck and starts to cut till the given number of work-pieces has been cut. The machine feeds the work-piece with the help of a conveyor, which is driven by a DC motor and an IR sensor ensures that the feeding stops when the specified length has been reached. A pneumatic cylinder is used for holding the work-piece when cutting operation is done. An AC motor is used to bring about the reciprocating motion required for cutting the work-pieces. There is a self-weight attached with the reciprocating mechanism to provide the necessary downward force required for penetration of hacksaw blade in to the work-piece. When a single piece has been cut, a limit switch will get triggered by the self-weight mechanism, which is sensed by the microcontroller to start the cyclic operation again provided if the specified number of work-pieces has not been cut.

### 7.3 Proposed Methodology

The demerit of power hacksaw machine is the automatic feeding of work-piece is eliminated by feeding of work-piece with the help of a conveyor, which directs the work-piece in to the chuck. The conveyor motor is stopped when it has fed the specified length in to the chuck with the help of a microcontroller and IR sensor. After this, a pneumatic cylinder is extended to hold the work-piece firmly to arrest the movement of work-pieces when being cut. This is achieved by a solenoid operated DCV, controlled by a microcontroller. Then the self-weight attached to the blade, which would be previously in a lifted position by means of another pneumatic cylinder will be lowered so that the hacksaw blade will contact the work-piece at the point where the cutting is to be done.



## VII PROPOSED MODEL



**Fig4. Proposed Model Using CATIAV5**

## VIII COMPONENTS AND WORKING

### Components Involved

1. Cutting machine
2. DC motor for cutter
3. DC motor for pipe
4. DC motor for VICE
5. Vice clamp
6. PVC pipe
7. Cutter blade
8. Gear arrangement to move pipe

### WORKING

As we see the components of machine. The L shaped frame structure in that. As locates in fig. arrangement set. There are 3 DC motors. First motor for move the pipe ahead as timer set. when the motor stop running, the second motor start which is for clamping the pipe fit with the help of screw jack. When clamed completed the third motor start & The cutter is attached to this motor. so that cutter move along the direction of pipe. An hexa blade which is made from abrassive material is cut the pipe at cutting section. And motor goes to their back position. so this peecess working continuously.....

### 8.1 Cutting Machine

In the context of machining, a cutting tool or cutter is any tool that is used to remove material from the work-piece by means of shear deformation. Cutting may be accomplished by single-point or multipoint tools. Cutting tools must be made of a material harder than the material which is to be cut, and the tool must be able to



withstand the heat generated in the metal-cutting process. Also, the tool must have a specific geometry, with clearance angles designed so that the cutting edge can contact the work piece without the rest of the tool dragging on the work piece surface. The angle of the cutting face is also important, as is the flute width, number of flutes or teeth, and margin size. In order to have a long working life, all of the above must be optimized, plus the speeds and feeds at which the tool is run. Here we use circular saw machine for our project.

A **circular saw** is a power-saw using a toothed or abrasive disc or blade to cut different materials using a rotary motion spinning around an arbor. Circular *saws* may also be loosely used for the blade itself. Circular saw blades are specially designed for each particular material they are intended to cut and in cutting wood are specifically designed for making rip-cuts, cross-cuts, or a combination of both. Circular saws are commonly powered by electricity, but may be powered by a gasoline engine or a hydraulic motor which allows it to be fastened to heavy equipment, eliminating the need for a separate energy source.

**Characteristics:**

- Cutting is by teeth on the edge of a metal blade or by an abrasive wheel
- The cut has narrow kerf and relatively smooth surface finish
- Cuts are straight and relatively accurate
- The saw usually leaves burrs on the cut edge of metal and plastic (which should then be addressed with sand paper)
- Saw setting should be done geometrically

**8.2 DC MOTOR**

Almost every mechanical movement that we see around us is accomplished by an electric motor. Electric machines are a means of converting energy. Motors take electrical energy and produce mechanical energy. Electric motors are used to power hundreds of devices we use in everyday life. Motors come in various sizes. Huge motors that can take loads of 1000's of Horsepower are typically used in the industry. Some examples of large motor applications include elevators, electric trains, hoists, and heavy metal rolling mills. Examples of small motor applications include motors used in automobiles, robots, hand power tools and food blenders. Micro-machines are electric machines with parts the size of red blood cells, and find many applications in medicine. Here we are using 3 DC motors one for clamping purpose i.e. for vice, second for linear movement the pipe and the third for driving the cutter blade.

**Features:**

- 12V DC motors with Gearbox
- 3000RPM base motor
- 6mm shaft diameter with internal hole
- 125gm weight
- 2kgcm torque



- No-load current = 60 mA(Max), Load current = 300 mA(Max)



Fig 5. DC Motor

### 8.3PVC PIPE

PVC pipes are made out of a material known as polyvinyl chloride, a durable, strong plastic-like substance. Pipes are constructed from this material and used in various applications from plumbing to construction. The pipe is designed to be universal. All pipes are designed around specific requirements to ensure that multiple pipe sections will fit together. The ends of the pipe can either be smooth or grooved (similar to a screw). Additionally, there are several different pipe sizes ranging from very small (one-fourth inch) to very large (10 feet). Currently, PVC piping counts for the majority of plumbing in the U.S. and is the preferred standard for new construction.

### 8.4BASE FRAME

L Channel- MS Angles are L-shaped structural steel represented by dimension of sides & thickness. For e.g. 25x25x3 means, both the sides of angles are 25mm & thickness is of 3mm. There are various sizes of angles which are as follows :- (there are also equal & unequal angles). Equal angles: - They are angles having both the sides of equal dimensions. For e.g. refer below given diagram, in which both the sides are of dimensions "a".

WE design a basic frame for a prototype by mild steel channel (L beam),

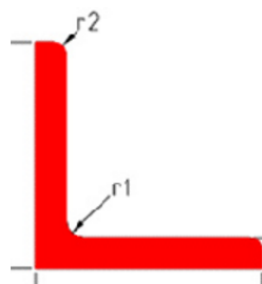
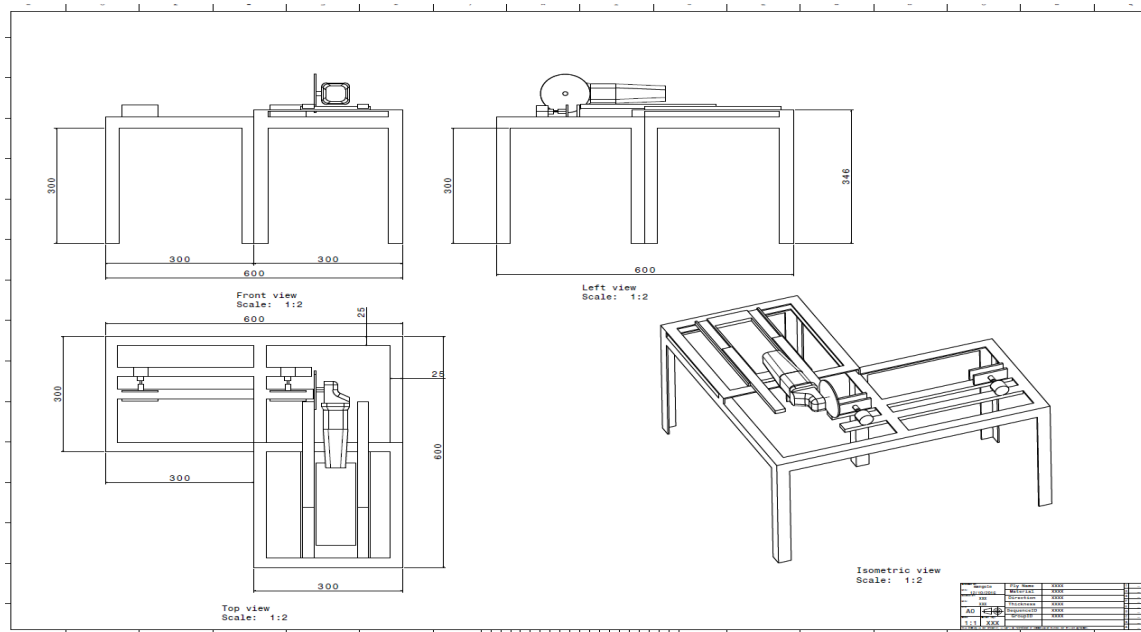


Fig 7. L-Angle Bar Dimensions

1. SIZES WITH SECTION WEIGHT OF EQUAL ANGLES

Size	Weight in Kgs.	Gauge	Thickness
in mm	Per Feet	Per Mtr.	
20x20x3	0.274	0.899	3mm
<u>25x25x3</u>	0.335	1.099	3mm
25x25x5	0.548	1.798	3mm
31x31x3	0.390	1.280	3mm

By standard available sizes we select the 1 inch= 25 mm so because that will be easily available and have appropriate size for frame.



IX ADVANTAGES AND APPLICATIONS

9.1 Advantages

1. Loading time reduced due to automation achieving faster production.
2. Mass production is possible with little modification.
3. Easy setup.
4. Can be operated with unskilled worker.
5. It is portable.
6. Less maintenance

## **9.2 Limitations**

1. Additional cost required to do further automation.

## **9.3 Applications**

Our project has wide range of applications in industries:

1. Small and medium Metal Cutting Industries.
2. Workshops use.

## **X CONCLUSION**

Thus, this work provides an alternative to the existing automatic PVC pipe cutting machine, in terms of automating the pipe entry into the cutting apparatus, eliminates power fluctuation and lesser initial investment.

Time consumption is less when compared to manual cutting. This work provides the desired output.

## **ACKNOWLEDGEMENT**

We wish to express our sincere thanks and gratitude to **Prof .Dr.P.A.Makasare** for his enthusiastic and valuable guidance. In spite of his busy schedule, he offered us his valuable time for the guidance for our project work. So we could complete our half project on “**AUTOMATIC BAR FEEDING MECHANISM FOR PIPE CUTTING MACHINE**”.

We would like to express our honour, respect towards HOD of Mechanical Department **Prof .Dr.P.A.Makasare** for giving us all guidance required for our Project work.

We also express our deep sense of gratitude to all those who directly or indirectly helped us in completing our project work.

## **REFERENCE**

1. Automatic stock bar feed mechanism for automatic screw machines, Patent No. US 2300457 A by MARIOTTE, Filed Sept. 24, 1940 2 Sheets-Sheet 2 Patented Nov. 3, 1942 UNITED STATES PATENT OFFICE AUTOMATIC STOCK BAR FEED MECHANISM FOR AUTOMATIC SCREW MACHINES..KshirsagarPrashant R. , RathodNayan J , RahatePrashant P , HalayePrashant P , SurveSachin S, ,International Journal for innovative research in Science and Engineering, Volume No. 01, Issue 02, March 2016.
2. Theoretical Analysis of Multi-Way Power Hacksaw Machine by Prof. MuthuKrishnan.A, Sre. NandhaGuhan. K.S, 5th International & 26th All India Manufacturing Technology, Design and Research Conference (AIMTDR 2014) December 12th–14th, 2014, IIT Guwahati, Assam, India.
- 3 DESIGN AND DEVELOPMENT OF AUTOMATED VEGETABLE CUTTING MACHINE by Tony Thomas.A