# Pneumatic Rubber Cutting Machine

**Prof Manisha Makwana[1], Prof Mehul B Patel[2], Faizan Malek[3], Himanshu Koirala[4], Dharmil Patel[5]**
[1, 2, 3, 4, 5] Dept of Mechanical Engineering
[1, 2, 3, 4, 5] A D Patel Institute of Technology New V V Nagar

***Abstract-*** *In this is paper we tried to focus on solving a problem in cutting rubber ethylene propylene of shore hardness 50A.The problem was that currently the workers were cutting the raw material which is rubber manually using a hacksaw or scissors. The process was bit tedious and also the rubber raw material which was cut was not that precise. The accuracy of cutting raw material was dependent on the efficiency and experience of the worker. Also the raw material had to be extruded again. This led to wastage of power and unnecessary processes had to be carried out. So in order to overcome this problem we are trying to design and fabricate the dedicated rubber cutting machine which would ease the operation of cutting and also reduce the time consumption and cost of production.*

***Keywords-*** Pneumatic Rubber cutting machine, pneumatic piston

## I. INTRODUCTION

The cutting of the rubber in industries was either done by scissors or by a hacksaw by the worker depending upon the diameter of the rubber available.

The process was tedious and time consuming for the workers. Also, the production time was high as this method would take a lot of time. Moreover, the accuracy of the process was dependent upon the accuracy of the worker and his experience.

For the above mentioned disadvantages of prior technology our team decided to make a machine which can be used for cutting the rubber precisely without any leftovers of material and can be used to reduce the production timing and material wastage. The main aim and objective of the project is to design and fabricate a strong sturdy machine which would help the worker to cut the rubber of required size accurately into the requisite measurement keeping in mind the workers safety.
Moreover, the main objective of this machine is to reduce the production time, reduce wastage, reduce rejection rate and improve accuracy and to set a standard for different diameters of rubber raw material.

## 2 .OPREATION AND DESIGN OF PNEUMATIC RUBBER CUTTING MACHINE

### 2.1 Working Principle

The method used to cut rubber in this machine is done by shear action during the downward stroke. The return stroke is idle. Two support columns support the tool during cutting action in downward stroke. The cutting tool is to be mounted on a rectangular bar on which the rod end of cylinder is attached and support columns are attached. This structure helps to support the tool with minimum vibrations and helps proper cutting of rubber. 2.2 Components of Pneumatic rubber cutting machine:

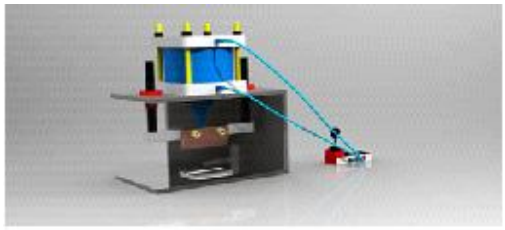

Fig:1 3-D Model Of Machine

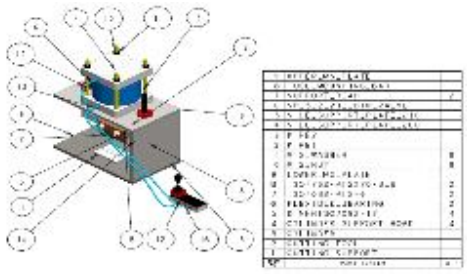

Fig: 2 Creo Software Model

Different apparatus which are used in pneumatic rubber cutting machine are as follows

- Cutting Blade
- Double acting Pneumatic Cylinder
- 5/2 Direction control hand operated valve
- Poly urethane Tubes
- Frame
- Compressor

2.2.1 Cutting Blade:

- Cutting blade is made of HSS.

- The properties of High speed steel are as follows High working hardness
- High wear resistance
- Excellent toughness.
- Compressive strength
- High withholding of hardness and red hardness
- Strength to prevent breakage on the cutting edge. The influence of alloying elements on steel properties: Carbon.

2.2.2 Double acting pneumatic cylinder:

Double acting cylinders are used in which juice power can be applied to the movable element in two directories. The force exerted by the compressed air moves the piston in two directories in a double acting cylinder. They are used predominantly. The piston is required to

Perform work not only on the advance movement but also on the return. In principle, the stroke length is limitless, while bucking and bending must be considered before we select a exacting size of piston diameter, rod length and stroke length. The base end cover has a bore in Centre whose diameter is slightly larger than piston rod diameter. The force during the return stroke is less compared to that of the forward stroke because in the former, the piston rod covers some area so that the air cannot focus in the piston rod area.

The double acting cylinder consists of

- Cylinder tube
- Piston
- Tie rod
- Piston rod
- Barrel End covers (flanges) Fig no 2
- Cap end port
- Rod end port

2.2.3 5/2 Hand operated directional control valve:

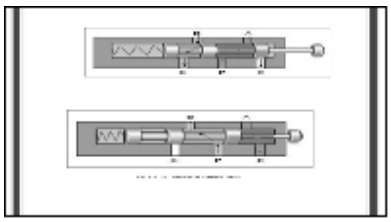

Fig: 2(5/2 DCV)

To control the to and fro action of a pneumatic cylinder, the air energy has to be regulated, controlled, and upturned with a preset sequence in a pneumatic system. Likewise one has to control the magnitude of pressure and flow rate to generate desired level of force and speed of actuation. To achieve these functions route control valves are used to-

- Start and stop pneumatic energy,
  Control the direction of flow of compressed air,
- Control the flow rate of the compressed air,
- Control the pressure rating of the compressed air.
  2.2.4 Frame

Base:It forms the robust shore up to stand the machine upright. It holds the weight of the vertical post and supports the direction control valve. It is made of mild steel channels of rectangular base with the vertical post and the horizontal channel.

2.2.4 Polyurethane tubes:

Polyurethane (PUR and PU) is a polymer collected of organic units attached by carbonated (urethane) links.

While most poly urethanes are thermosetting polymers that do not melt when excited.

This matter is used to produce tubes which are used to carry energy in the form of compressed air in a pneumatic system.

2.2.5 Compressor:

The air under high load is supplied by a compressor. It is driven by an electric motor. The compressor delivers air to inlet of the cylinder. An air compressor as the same indicates is a machine to compress the air and to raise its pressure. The air compressor sucks air from the atmosphere, compresses it and then delivers the same under a high pressure to a storage vessel from the storage vessel it may be conveyed by a pipeline to a place where the supply of compressed air is required.

- Increased storage capacity.
- Increased safety.
- Reduction in fatigue.
- Improved personnel comfort.

2.3 Construction

Pneumatic rubber cutting machine consists of a pneumatic cylinder 150mm bore diameter and 50mm stroke length. The cylinder is mounted on a M.S plate of 12mm thickness and having dimension of top plate of frame on

which cylinder is to be mounted is 350*210mm. The proper cutting of M.S sheet using arc welding was carried out to get the desired size of plates.

Fabrication of the frame was carried out using welding process. Holes were drilled as per requirement on the frame and mounting of cylinder was done. The rod end of cylinder was connected to rectangular block of M.S on which cutting tool is mounted. The rectangular block was supported by two column attached at each end as shown in figure.

Fig: 3 M.S Plate

Cutting tool was mounted on rectangular block using Allen bolts

Fig : 4 Mounting of cylinder on Frame

2.2.6 Double acting pneumatic cylinder

Double acting cylinders are used in which juice power can be applied to the movable element in two directories. The force exerted by the compressed air moves the piston in two directories in a double acting cylinder. They are used predominantly. The pist on is required to perform work not only on the advance movement but also on the return. In principle, the stroke length is limitless, while bucking and bending must be considered before we select a exacting size of piston diameter, rod length and stroke length. The base end cover has a bore in centre whose diameter is slightly larger than piston rod diameter. The force during the return stroke is less compared to that of the forward stroke because in the former, the piston rod covers some area so that the air cannot focus in the piston rod area.

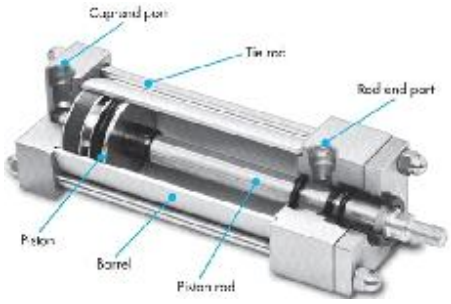


Fig: 6 Pneumatic cylinder

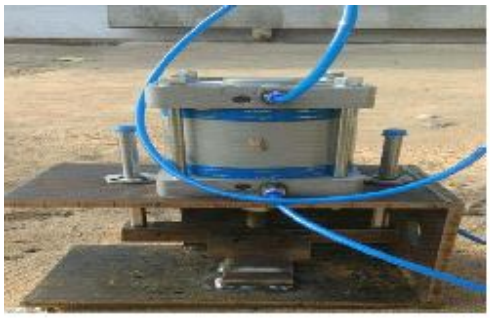

Fig: 12 Final Model

## III. RESULTS AND DISCUSSION

3.1 Advantages:

We have predicted the following advantages of the machine that we are designing:

- Less Human Efforts.
- More Efficient.
- Less time consumption.
- Reduce in rejection rate.
- Less Power consumption.
- Higher accuracy.
- Production rate is high.

3.2 Disadvantages:

- Feeding of material is still done manually.
- Cutting of material up to certain diameter is possible (24mm).

3.3 Future Scope:

- Automatic material feeding mechanism can be incorporated in Rubber cutting machine by using roller feeder mechanism.
- Adjustable variable guide way so that rubber material of different diameter can be feed.
- Using dedicated sensors for automatic length selection and precision cutting.

- Minimizing operator's engagement with the machine.

## IV. CONCLUSION

From this project we conclude that this machine has far better accuracy and production rate than manual rubber cutting operation. The cutting speed increases compared to manual cutting. Hence it operates on pneumatic system, the system is clean. There are no problems of oil leakage like hydraulic system. There is low wastage of material. Rejection rate is less and efficiency of machine is high.

Problem solved:

In present project effort have made to minimize or eliminate some of the problems of manual cutting.

The specific problem solve by this project are as under:

- Production time or cutting time per piece is reduced.
- Compact size will allow a portable application of machine
- Drastically reduce the engagement of operator with the machine.
- During breakdown ease of locating fault due to simple construction.
- •Less material wastage in cutting than earlier.

## REFERENCES

[1] Design and Fabrication of an Auto cutter for Rubber Sheet Cutting, Dr. L. K. Tokeb IJSRD - International Journal for Scientific Research & Development Vol. 5 Issue 03, 2017
[2] Fabrication of Pneumatic Shearing Machine , M.Khaja Gulam Hussain, T. John babu IJRTI Volume 1, Issue 2
[3] Ethylene–propylene– diene terpolymer / hexafluoropropylene–vinylidinefluoride dipolymer rubber blends: Thermal and mechanical properties, Ajalesh Balachandran Nair, Philip Kurian, Rani Joseph, 11/2/2011
[4] Design and Fabrication of Pneumatic Sheet Metal Cutting and Pneumatic Sheet Metal Bending Machine Dinesh Lamse, Akash Navghare, Rahul Chavhan, Ajay Mahawadiwar, Volume: 04 Issue: 03March 2017
[5] Experimental Investigation and Fabrication of Pneumatic Punch , A. K. Gupta1, P. Bharadwaj2, S. Sahgal3, P. M. Pradhan, Vol. 2, Issue 6, June 2013
[6] Fabrication of Pneumatic Sheet Metal Cutter, Raj Reddy, 7(2): 360-365(2016)
[7] Axial cutting of AA6061-T6 circular extrusions under impact using single- and dual-cutter configurations, Shun Yi Jin, Amitabha Majumder, William Altenhof*, Daniel Green, 1990) 45, 77-88
[8] Pneumatic Reciprocating Hacksaw Machine, K.Sathishkumar, N.Ugesh, K.Vignesh and P. B.Sanjeeva Prasath, Vol.03 Issue03 March 2016