

# Review on Design and Development of PLC Operated Cutting Machine

**Prof. Amey S. Shirodkar**

*Assistant Professor*

*Department of Mechanical Engineering*

*Shivajirao S. Jondhale College of Engineering, Mumbai University*

**Bhagyesh A. Vaidya**

*UG Student*

*Department of Mechanical Engineering*

*Shivajirao S. Jondhale College of Engineering, Mumbai University*

**Swapnil V. Sawant**

*UG Student*

*Department of Mechanical Engineering*

*Shivajirao S. Jondhale College of Engineering, Mumbai University*

**Pramod R. Shirke**

*UG Student*

*Department of Mechanical Engineering*

*Shivajirao S. Jondhale College of Engineering, Mumbai University*

**Rohit B. Mundhe**

*UG Student*

*Department of Mechanical Engineering*

*Shivajirao S. Jondhale College of Engineering, Mumbai University*

## Abstract

This paper reviews the PLC applications in the industry of cutting machines. This paper also reviews the PLC properties, different types of hacksaw used for cutting purposes. Today, there is lot of advancements in these fields as every industry is getting automated. For cutting materials for mass production conveyor systems are widely used. There are two types of conveyor: Belt type and Roller type. Feed of cutting materials is also done with the help of conveyor. Pneumatic System is used for smooth operation of hacksaw.

**Keywords-** PLC, Hacksaw, Feed, Conveyor, Pneumatic System

## I. INTRODUCTION

Today conventional cutting processes are getting out of the scenario. Conventional cutting processes are getting automated by use of PLC i.e. Programmable Logic Controller. CNC machines, Pneumatic cutting machines, etc are used for cutting processes. In this Pneumatic cutting machines using PLC is widely used because of their flexible nature. For transportation of one material from one location to other location conveyors are used. They can carry heavy weights from light weight to tones of material. Conveyors today are also automated which reduces the human effort and increases the productivity. In large scale industries, for mass production there will be need of number of cutting rods (similar length). Manually it will take long time and thus increases the production cost.

### A. PLC

[1]A programmable logic controller is a digital, industrial computer which is made up of integrated circuits. Logic in PLC is concerned with the implementation of switching operations. Input devices like PLC is various sensors, limit switches, pushbuttons, etc and output devices like alarms, solenoids, etc. are connected to the PLC. Then, controller monitors the inputs and outputs according to the program which is stored in memory of PLC. In PLC, the program is transferred from personal computer through programming board which writes the program into a removable chip such as EPROM. Most of PLC works under 24 VDC or 220 VAC. Some PLC have electrical supply separate module, while small and medium series already contain the supply module. In this case, PLC is going to accept inputs from proximity sensor, controls the motion of conveyor and cutting motor.

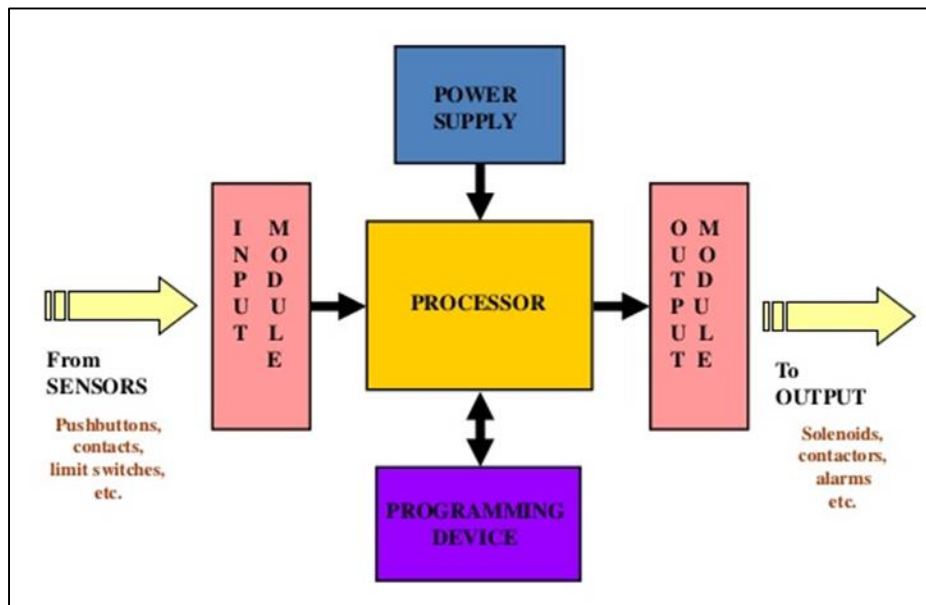


Fig. 1: Block Diagram of PLC

### B. Conveyors

Conveyors are continuous conveying machines. There are various types of conveyors like roller conveyors, belt conveyors, etc. Main part of conveyor is drive unit which includes electric motor for inducing motion, gearbox for speed reduction and couplings. Belt Conveyor system uses belt of natural rubbers, styrene-butadiene, other synthetics, ethylene propylene – based polymer, silicones, etc. Speed of belt generally varies between 1.5 m/s to 4 m/s.

### C. Pneumatic Hacksaw

Pneumatic cutting machine works under pressurized air from the compressor having range of 4-6 MPa. Pneumatic System generally consist of Pneumatic Cylinder which operates by means of compressed gas to provide forward and backward motion of piston in cylinder, Solenoid Valve also known as direction control valve (DCV) and it is mainly used in pneumatic system to control the air flow direction, Proximity Sensor which emits an electromagnetic radiation which identifies the presence of the object when intensity of radiation changes without any physical contact. Pneumatic cutting machines are less hazardous and increases productivity by reducing human intervention.

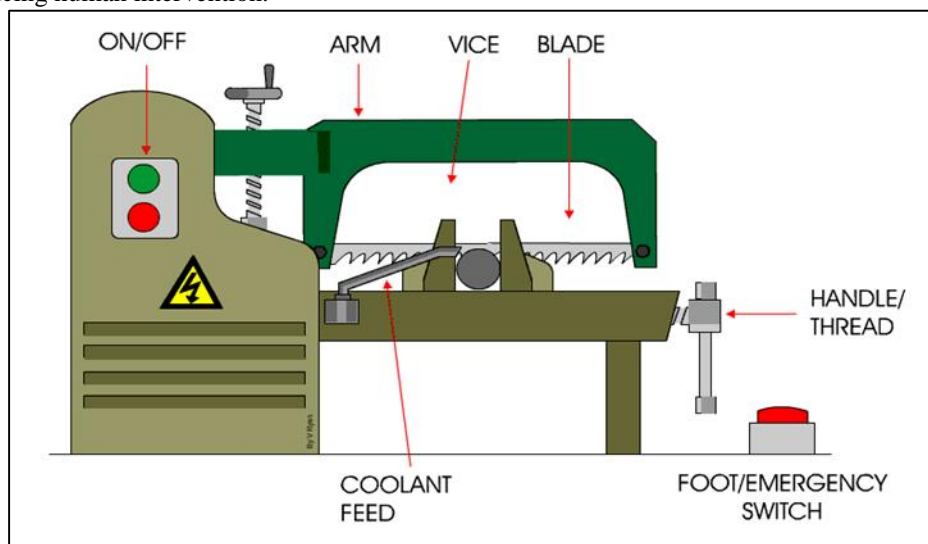


Fig. 2: Pneumatic Hacksaw

## II. LITERATURE REVIEW

Students of Bapurao Deshmukh College of Technology, Wardha [2] have published a research paper on conveyor system. Conveyors are used for carrying or moving materials from one location to another. Conveyor is modelled by using CAD software and ANSYS. Improved methodology for design and production of conveyor components is based on the minimization of materials,

parts and costs, using the rules of design for manufacture and design for assembly. There are different components of conveyor are as follows:

Table 1: List of Components in Conveyor

SR. NO.	COMPONENT	MATERIAL	QUANTITY	DIMENSIONS
1.	C-Channel	C-10	2	75X40X2.3X2480 mm
2.	Rollers	MS	35	$D_1 = 32\text{mm}$ , $D_2 = 29\text{mm}$
3.	Shaft	MS	35	12mm diameter
4.	Sprocket	MS	35	16 Teeth
5.	Bearing	-	70	30X12X15
6.	Chain	MS	21m	Chain No. 40

They have got optimized solution by ANSYS for dedicated conveyor system for the continuous filling of liquid in the cartons having chamber of two types 1 X 16 (4 X 4) and 1 X 25 (5 X 5). They have tested their assembly which is very stable and deformation of 0.0541 mm is generated. Stress induced is 4.047 MPa which is below their designed limit.



Fig. 3: Systematic Conveyor

Rushikesh Gadale, Mahendra Pisal, Sanchit Tayade, S.V. Kulkarni [3] have research on PLC based cutting machine. Their cutting system is pneumatic and they have used PLC for automation. PLC is used in control industry for replacing relay logic systems. Basic function of PLC is to scan program continuously. It includes:

- Testing the inputs: It is the first step of the process. It checks whether sensor is working or not, etc. Information obtained through this is stored in the memory of the PLC.
- Execution of the Program: Program which is fed into the PLC is executed based on the inputs obtained. Execution includes activation of certain outputs like buzzer, relay circuit, etc.
- Correction of the output: If there is some error then PLC detects it. Based on this, changes are carried out.

### III. APPLICATIONS

By referring Conveyor system research paper we have seen the optimization for designing the conveyor. Many mechanical, Production industries requires conveyor system which should be strong enough to carry maximum load at low power. Cutting machines by using PLC works faster than earlier ones. Also, complex coding system and tedious relay wiring has been overcome by ladder logic diagram. Piping Industries, Water Purification Industries, etc have huge use of this system in their business.

### IV. CONCLUSION

Results obtained by minimization of materials, parts, etc benefits the conveyor system used in cutting machine. The overall material cost was reduced by 19%. Not only capital is saved but development time for manufacturing of such systems is shortened. PLC operated not only cutting machines but several applications like water bottle filling machines, industrial robots, etc are being developed. Future scope of PLC is very vast in every dimension of manufacturing industries.

### ACKNOWLEDGEMENT

We are very glad to present our review paper on design and development of PLC operated cutting machine. Many people have contributed directly or indirectly in successful making of this project topic and we would like to appreciate them. We are very much obliged to our project guide Prof. A. S. Shirodkar for guiding us. His valuable suggestions contributed for systematic and timely completion of our project report work. We would equally also like to thank our Incharge Head of Department Prof. V. M. Magar and our honourable Principal Dr. J. W. Bakal for their co-operation and valuable guidance.

## REFERENCES

- [1] Akhil Dixit, Rahul Mendiratta, Tripti Chaudhary, Naresh Kumari “Review Paper on PLC & Its Applications in Automation Plants” International Journal of Enhanced Research in Science Technology & Engineering, Vol. 4 Issue 3, March 2015, pp: (63-66).
- [2] Pradnyaratna A. Meshram and Dr. A. R. Sahu “Design, Modelling and Analysis of conveyor system used for transportation of Cartons” International Journal of Research in Advent Technology, Vol.4, No.1, January 2016.
- [3] Rushikesh Gadale, Mahendra Pisal, Sanchit Tayade, S.V. Kulkarni “PLC based automatic cutting machine” International Journal of Engineering and Technical Research, Volume-3, Issue-3, March 2015.
- [4] <https://en.wikipedia.org/wiki/Hacksaw>
- [5] [https://en.wikipedia.org/wiki/Programmable\\_logic\\_controller](https://en.wikipedia.org/wiki/Programmable_logic_controller)
- [6] [https://en.wikipedia.org/wiki/Conveyor\\_system](https://en.wikipedia.org/wiki/Conveyor_system)
- [7] <http://www.technologystudent.com/equip1/phcksw1.htm>