

# Using Advanced Pneumatics Automation of Conventional Sheet Bending Machine

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## Abstract

Various technologies have been developed for automation. Technologies developed till date are playing an important role in all industry to increase production, reduce labor costs, reduced cycle time, reduce the maintenance cost and improve product quality, reduce possibility of accident etc. Stepper Module, a component of advanced pneumatic is introduced for the automation of conventional sheet bending machine operations and to overcome the signal overlapping. In a sheet metal work shop bending machine plays an important role. It is designed for Sheet bending. The bending machine is used to bend the sheet work piece according to requirement. Automation is performed with the help of Advance pneumatics system.

**Keyword:** -Pneumatics, Stepper Module, Pneumatically Operate Valve, Limit switch, Cylinder etc.

## 1. Introduction

Bending machine widely used in industries and it takes so much time to perform the operation. Where bending machine operated manually, productivity of machine is very low. Now bending operations are performed automatically. Once the work piece is placed on the die, operations are performed automatically with the help of advanced pneumatics. In this project we achieved the semi automatic bending machine, in which the loading and unloading is achieved manually and the bending of the sheet is done automatically.

Vijaylaxmi g. Biradar et al. 2012 (1) used this technology to convert the conventional sheet bending machine into semiautomatic sheet bending machine using electro pneumatic devices thus increasing the productivity with less cycle time and less man power. Young chang 2005(5) describe the low cost automation. Pragnyapradeep et al. 2012 (9) converts the conventional milling machine into automated milling machine using electro pneumatic system with reduced human intervention. Phillip F. Ostwald et al. 2008(10) developed an automation of manufacturing processes and system. B. Prabhu et al. 2012 (11) obtained the glass cutting machine using pneumatic system and describe low cost automation. Arun S. et al. 2014 (15) obtained automatic punching machine using

electro pneumatics with reduced manufacturing lead time and more worker safety.

In advance pneumatics multi-cylinders are operated in sequence manner. There are so many devices used in the advanced Pneumatic system like Compressor motor, 3/2 way valve pneumatically operated & 5/2 way valve pneumatically operated, 3/2 way valve with pushbutton (Mechanical operated), Double acting cylinder, Pressure sequence valve, Stepper module. All of these except compressor motor, no other devices uses electricity. To start the operation we have to actuate the pushbutton which is mechanically operated. Pneumatically operated 3/2 valve functions as a valve providing alternate path for the compressed air to reach the cylinder to complete the operation. Generally in pneumatics air moves the spool.

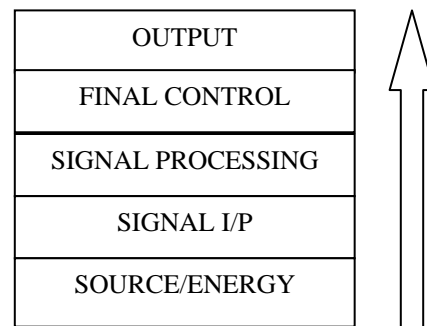


Figure1 Structure of Advance Pneumatics

### 1.1 StepperModule

It is used for multi cylinder actuation purpose. It is most commonly used in advanced Pneumatics. In multi cylinder actuation there is a problem of signal overlapping. When simultaneously signals applied to two pilot ports of two pilot valves, the actuation of any of the valve is prevented because the signal applied first always dominates. Due to signal overlapping cylinders are not actuated in a required sequence thus the system does not operate in proper way. So stepper module is used to overcome the signal

overlapping because of it is always operate in sequence manner.

### 1.2 Principle of Stepper system

- Number of stages is equal to the No. of signals
- Only one output, which is required is available, whereas all other are suppressed
- Each stage is Re-Set by the stage which follows it
- In the initial condition all memory is erased except the last memory
- In order to Re-Set the memory an OR Gate is provided so as to erase all memory and set the last memory
- Each module have 4 input and 4 output internally connected pneumatically.

### 1.3 Types of Stepper Module

1. TAA – This module cannot be used by itself. It is used in conjunction with TAB module when the no. of inputs is more than 4 and also the outputs are more than 4.
2. TAB - This module can be used by itself. If the no. of inputs is not more than 4 and also the outputs are not more than 4. This has a re-settling feature.

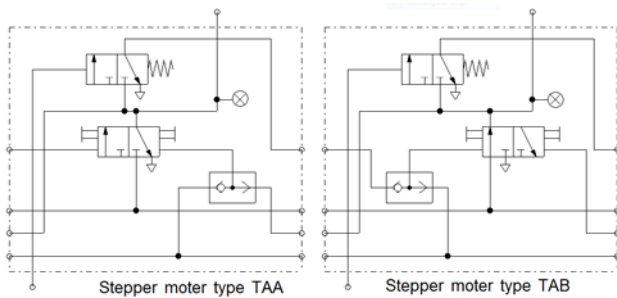


Figure 2 Stepper module

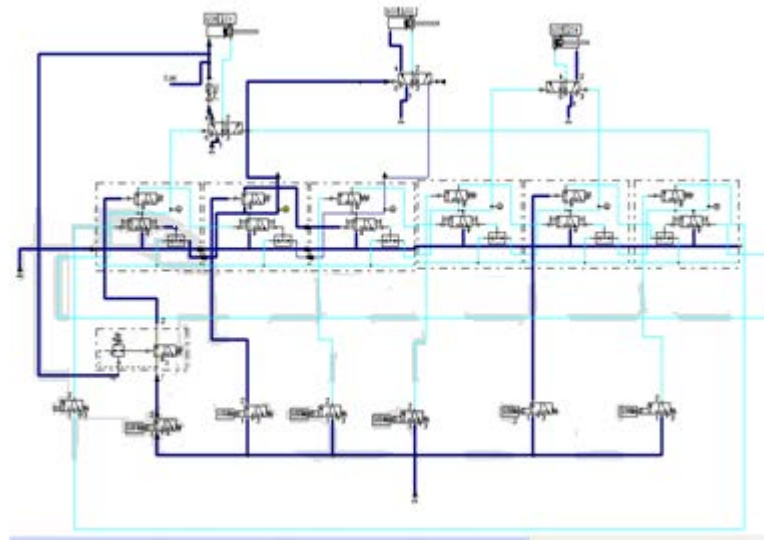
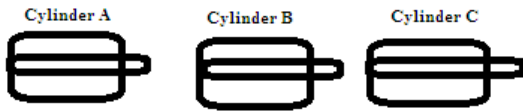


Figure 3 Advanced-pneumatic circuit

## 2. Working of the System

In the Pneumatic system more than one cylinder is used. The cylinder movement is coordinated as per required sequence. The limit switch is used to provide set or reset signal to the final control valve for controlling the movement of cylinders. So the limit switch has to be arranged in proper location. Here the movement of the cylinder A, Cylinder B, and Cylinder C is controlled with the help of limit switch. As we press the start button stepper module 1 will actuates and it operates the 5/2 valve pneumatically therefore the Piston of Cylinder A will extend and when it reaches the limit switch L1. Thus limit switch L1 actuates consequently stepper module 2 will actuates and operates the 5/2 valve pneumatically therefore the Piston of Cylinder B will extend and when it reaches the limit switch L2. Thus limit switch L2 actuates consequently stepper module 3 will actuates and operates the 5/2 valve pneumatically therefore Piston of Cylinder B will retract and it reaches the limit switch L3. Thus limit switch L3 actuates consequently stepper module 4 will actuates and operates the 5/2 valve pneumatically therefore Piston of Cylinder C will extend and when it reaches the limit switch L4. Thus limit switch L4 actuates consequently stepper module 5 will actuates and operates the 5/2 valve pneumatically therefore Piston of Cylinder C will retract and when it reaches the limit switch L5. Thus limit switch L5 actuates consequently stepper module 6 will actuates and operates the 5/2 valve therefore Piston of Cylinder A will retract.

### Sequence of Operation



Clamping/Unclamping PunchingPart1Punching Part 2

It is possible to have the following sequence of operation

A + B C  Clamping

A + B + C  Clamping

Punching

A + B - C +  Clamping

Retracting Punching

A + B C -  Clamping

Retracting

A - B C  Unclamping

A B C  Reset condition

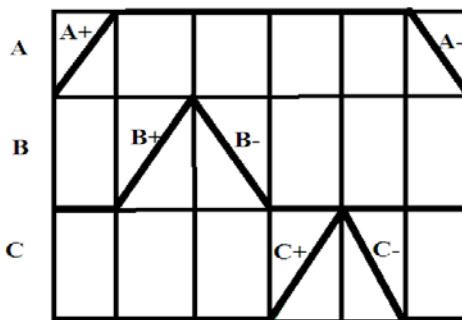


Figure 4 Function Diagram

### 3.Objective and Scope of study

The study is about to automate every machine in manufacturing industry. Automation, as we all know is a need of developing world in each and every field. Today, almost all MNC'S or Public Sector units greatly emphasizes on automation. Since it completely discard the human error, high cost and enhance the quality of product. Even Medical field is also influenced by automation using pneumatics. Furthermore automation of conventional operating machine is a step of growth of our manufacturing standards. Here, in this paper we have automated the sheet bending machine by using advanced

pneumatics. Here, with very less input, we could achieve a qualitative and quantitative output.

### 4. Result and Discussion

Thus all the operations of the sheet bending machine are performed automatically and efficiently with the help of advanced pneumatic devices and the problem of signal overlapping is eliminate with the help of stepper module therefore system will operate in proper way. Thus we increase the productivity of the machine and reduce the effective cycle time. In this automation process less human interface and operations are more reliable and optimized. During the automated process possibility of accidents are less and product quality is also good.

### 5. Conclusion

This paper shows the automation of conventional sheet bending machine operations with less human interface and the problem of signal overlapping is solved with help of stepper module. Thus the manually operated conventional sheet bending machine is converted into automatic machine and the problem of signal overlapping is eliminate with the help of stepper module. So operating time will be saved and output will be more. In this project the human intervention is for loading and unloading the plate. Through automation we can reduce labor cost, maintenance cost, cycle time, possibility of accident and thus it increase productivity, quality of product.

In this project, we understand that any manually operated machine can be converted into automatic machine using advanced pneumatic.

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