

DESIGN OF AUTOMATIC PNEUMATIC SHEET METAL AND PAPER CUTTING MACHINE

**¹SACHIN S RAJ, ²S.MANICKAM, ³M.MEGANATHAN,
⁴G.NANDHAKUMAR, ⁵M.PUSHPARAJ, ⁶Dr N.BALAKRISHNAN.**

¹Assistant Professor, ^{2,3,4,5}UG Students, ⁶Professor and Head of Mechanical Department
Department of Mechanical Engineering,
Gnanamani College of Technology, Namakkal(Dt)
Tamilnadu, India.

ABSTRACT:

In presently small scale industry are mostly used handmade operated system of sheet metal cutting. So that sheet metal are to be wasted sometime because of mistakes happened such as wrong dimensions etc. Also even a simple cutting may take long time. Hydraulic machines are also available sheet metal cutting. But this method is used for only heavy metal cutting and it's cost is very high. We are using a "AUTOMATIC PNEUMATIC SHEET METAL AND PAPER CUTTING MACHINE" for easy way to cutting.

KEY WORDS: Pneumatic Cylinder, High Speed Steel Blade, Solenoid Valve, Battery,

1.INDRODUCTION

1.1METAL WORKING:

Sheet metal cutting comes under the category of Metal working. Metalworking is craft and practice of working with metals to create individual parts, assemblies, or large scale structures. The term covers a wide range of work from large ships, bridges and oil refineries to delicate jewelry. It therefore includes a correspondingly wide range of skills and the use of many different types of metalworking processes and their related tools.

Metalworking is an art, hobby, industry, and trade. It relates to metallurgy, a science, jewelry making, an art-and-craft, and as a trade and industry with ancient roots spanning all cultures and civilizations.

At some imprecise point in the distant past humankind discovered that certain rocks now called ores could be smelted, producing metal. Further, they

discovered that the metal product was malleable and ductile and thus able to be formed into various tools, adornments and put to other practical uses.

1.2 SHEET METAL CUTTING MACHINE:

The main objective of our project is to perform job holding operation effectively with less human effort by incorporating a machine with the pneumatic power. This also takes less time due to its quick action. For a developing industry the operation performed and the parts (or) components produced should have it minimum possible production cost, and then only industry runs profitably.

2.NEED FOR AUTOMATION:

Automation can be achieved through computers, hydraulics, pneumatics,

robotics, etc., of these sources, pneumatics form an attractive medium for low cost automation. The main advantages of all pneumatic systems are economy and simplicity. Automation plays an important role in mass production.

Nowadays almost all the manufacturing process is being atomized in order to deliver the products at a faster rate. The manufacturing operation is being atomized for the following reasons.

- To achieve mass production
- To reduce man power
- To increase the efficiency of the plant
- To reduce the work load
- To reduce the production cost
- To reduce the production time

3.OBJECTIVES:

To design and fabricate pneumatic based sheet metal cutting machine to be used for the cut the sheet metal of minimum thickness without manual hard work instead we use pneumatic control system to operate the cutting machine accurately.

4.METHODOLOGY:

The sheet metal cutting machine works with the help of pneumatic double acting cylinder. The piston is connected to the moving cutting tool. It is used to cut the small size of the sheet metal. Auto Feed Pneumatic Sheet Metal Cutting Machine. The machine is portable in size, so easy transportable. The compressed air from the compressor is used as the force medium for this operation. There are pneumatic double acting cylinders solenoid valves, flow control valve and the timer unit is used. The sheet metal cutting process is a main part of the all industries.

Normally the sheet metal cutting machine is manually hand operated one for medium and small scale industries. Automation in the modern world is inevitable. Any automatic machine aimed

at the economical use of man, machine, and material worth the most. In our project is solenoid valve and control timing unit is used for automation.

The sheet metal cutting machine works with the help of pneumatic double acting cylinder. The manually operated machine is converted into pneumatically operated machine by applying proper design procedure. At the end of task, the conclusion is made and several recommendations are suggests to make an improvement about the result and the project for future study.

5.TYPES OF CUTTING MACHINES

PNEUMATIC OPERATED:

Here the advancement of the header is carried out in the upward and the downward direction using the pneumatic double acting piston and cylinder unit arrangement along with the foot operated direction control valve. In this type of machine high pressure air is used as the working fluid for the transfer of power and the motion. In this paper, the pneumatic driven manipulation system is driven by the pneumatic cylinders. The proposed system is built by the designed pneumatic force control system and the microscope, which are integrated with the control interface.

5.1 HYDRAULIC OPERATED:

Here the lowering and raising of the header is carried over using the hydraulic piston and cylinder arrangement. To actuate the piston and cylinder, the oil is allowed to enter the cylinder from front or the back side of the piston. But the oil is comparatively costlier and its leakage may cause so many problems. A hydraulic drive system is a drive or transmission system that uses pressurized hydraulic fluid to power hydraulic machinery. The term hydrostatic refers to the transfer of energy from flow and pressure, not from the kinetic energy of the flow.

5.2 RACK AND PINION OPERATED:

Here the lowering and the raising of the header are carried out manually using the rack and pinion arrangement. In this case the required pressure is applied manually using direct hand pressure on the rack using pinion and lever arrangement.

5.3 SPRING OPERATED:

The working of spring operated machine is similar to the rack and pinion operated machine but differs from it in construction. Here the lowering and the raising of the heating handle are carried out manually and it requires too much pressure for its operation and also there is possibility of having damage to the work piece if not handled carefully.

5.4 DESCRIPTION OF EQUIPMENT

PNEUMATIC CYLINDER:

A double-acting cylinder is a cylinder in which the working fluid acts alternately on both sides of the piston. In order to connect the piston in a double-acting cylinder to an external mechanism, such as a crank shaft a hole must be provided in one end of the cylinder for the piston rod, and this is fitted with a gland or "stuffing box" to prevent escape of the working fluid. Double-acting cylinders are common in steam engines but unusual in other engine types.

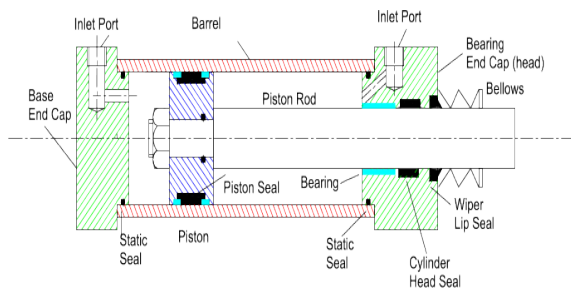


Fig 5.4 Pneumatic cylinder

SOLENOID VALVE:

A solenoid valve is an electromechanically operated valve. The valve is controlled by an electric current through a solenoid. In the case of a two-port valve the flow is switched on or off; in the case of a three-port valve, the outflow is switched between the two outlet ports. Multiple solenoid valves can be placed together on a manifold. Solenoid valves are the most frequently used control elements in fluidics. The pull type solenoid is one in which the plunger is pulled when the solenoid is energized.

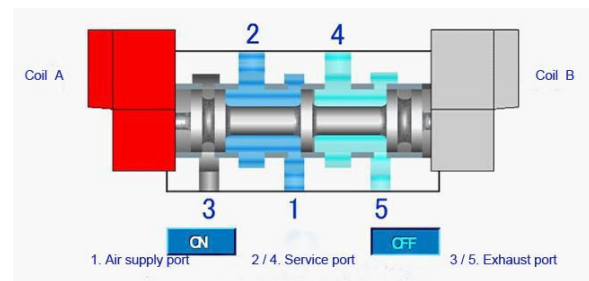


Fig :5.6 Solenoid valve

HIGH SPEED CUTTING BLADE:

Sheet metal is metal formed by an industrial process into thin, flat pieces. It is one of the fundamental forms used in metalworking and it can be cut and bent into a variety of shapes. Countless everyday objects are fabricated from sheet metal. Thicknesses can vary significantly.



Fig 5.6 High speed cutting blade

AIR COMPRESSOR:

An air compressor is a device that converts power (using an electric motor, diesel or gasoline engine, etc.) into potential energy stored in pressurized air (i.e., compressed air). By one of several methods, an air compressor forces more and more air into a storage tank, increasing the pressure. When tank pressure reaches its upper limit the air compressor shuts off. The compressed air, then, is held in the tank until called into use.

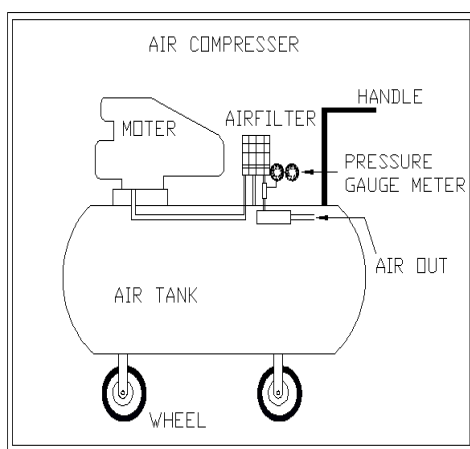


Fig 5.7 Air compressor

BATTERY:

To run the 12 volt dc compressor the battery required to run this compressor is of 12 volt. For fixed, non-mobile applications, Rechargeable lead acid batteries provide a good power-to-weight ratio. They also have high surge current capability and are well suited for driving DC motors for applications such as pumps that usually require high inrush currents. Photovoltaic technology combined with rechargeable lead acid batteries is a good solution.



Fig 5.8: Battery

SHEET METAL:

Sheet metal is metal formed by an industrial process into thin, flat pieces. It is one of the fundamental forms used in metalworking and it can be cut and bent into a variety of shapes. Countless everyday objects are fabricated from sheet metal.

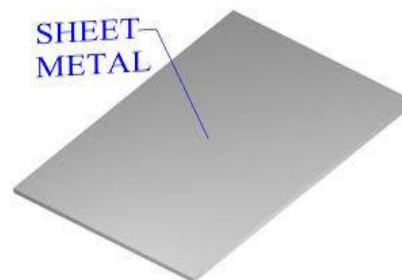


Fig 5.9 :Sheet metal

SPECIFICATIONS

PNEUMATIC CYLINDER:

Pneumatic cylinders are made up of steel, Aluminum and brass

Stroke length=160mm

Diameter =63mm

SOLENOID VALVE:

DC24V and 4.8W

Temperature raise=35

100% ED IP65

BATTERY:

Type =Lead-Acid Battery

Volts =12v

Amph=7ah

HIGH SPEED STEEL BLADE:

Size =8inch

POLYTHENE TUBE:

size =6mm.

WORKING OF SHEET METAL CUTTING MACHINE:

The sheet metal cutting and bending machine works with the help of pneumatic double acting cylinder. The piston is connected to the moving cutting tool. It is used to cut and bend the small size of the sheet metal. The machine is portable in size, so easy transportable. The compressed air from the compressor is used as the force medium for this operation. There are pneumatic double acting cylinders solenoid valves, flow control valve and the timer unit is used.

The controlled air from the flow control valve enters to the solenoid valve. The function of solenoid valves all of air correct time interval. The 5/2 solenoid valve is used. In one position air enters to the cylinder and pushes the piston so that the cutting stroke is obtained. The next position air enters to the other side of cylinder and pushes the piston return back, so that the releasing stroke is obtained. The speed of the cutting and releasing stroke is varied by the timer control unit circuit.

**ADVANTAGES:**

- The pneumatic is more efficient in the technical field,
- Quick response is achieved,
- Simple in construction,
- Easy maintenance and repair,
- Cost of unit is very less,
- No fire hazard problem due to overloading,
- Continuous operation is possible without stopping.

APPLICATIONS:

- Car bodies,
- Airplane wings,
- Medical tables,
- Roofs for buildings(Architectural) and many other things,
- Sheet metal of iron and other materials with high magnetic permeability,
- Electronic machines.

REFERENCES:

- 1) Madhu Kumar V, Arun Kumar N, Harsha B S, Naveen Kumar K N, Nagaraja T.K.2 International Journal of Engineering Research And Advanced Technology (IJERAT) ISSN: 2454-6135 [Special Volume. 02 Issue.01, May-2016].
- 2) A. Ilchmann, O. Sawodny and S.Trenn International Journal of Control Vol. 79, No. 6, June 2006, 650–661.
- 3) Ahmad Athif Mohd Faudzi, Numan Din Mustafa, and Khairuddin Osman. Hindawi Publishing Corporation Mathematical Problems in Engineering Volume 2014, Article ID 261829.
- 4) Shruti Saxena International Journal of Scientific & Engineering Research, Volume 6, Issue 5, May-2015 ISSN 2229-5518.
- 5) Balashanmugam, Assistant Professor, Mechanical Engineering, Annamalai University. IJRDO-Journal Of Mechanical And Civil Engineering ISSN: 2456-1479.
- 6) Vishal P. Patil, Shridhar S. Jadhav, Nilesh D. Dhas. SSRG International Journal of Mechanical