

Design and Fabrication of Pneumatic Sheet metal Automatic cutting & feeding machine

Mr.Vaibhav S Pakhare¹, Mr.Rushikesh L Mane², Mr.Rushikesh T Panchal³, Mr. Sushil S Pawar⁴, Mr. Adik yadao⁵

Department of Mechanical Engineering

^{1,2,3,4}BE Student, GH Raison college of Engineering And Manegement,Wagholi, Pune, Maharashtra, INDIA

⁵ Assistant Professor, GHRCEM, Wagholi, Pune, Maharashtra, INDIA.

Abstract- Automated pneumatic sheet metal feeding and cutting has been used to shear the sheets made of aluminium of various thicknesses. The pressure and force required for shearing these metal sheets have been listed accordingly. Automation in the process is incorporated by using microcontroller, inductive proximity sensor; electrically controlled solenoid valve with pneumatically operated cylinder and DC motor controlled roller feed system. The system works by

Keywords- Pneumatic, Automation, feeding mechanism, microcontroller.

I. INTRODUCTION

Pneumatic means which consists of air compressor, pipe lines, control valves and pneumatic cylinder. Pneumatic systems are useful when sheet metals are needed to be cut in hazardous areas such as oil and gas refineries and in chemical factories. Further it is observed that, the employment of automation system makes the cutting process accurate, time efficient and increases the productivity as compared to conventional non-automated cutting machine. Hydraulically operated machines are too costlier for small scale and medium scale industries. This paper deals with pneumatically operated cutting and bending machine. The bending machine is one of the most important machine tool in sheet metal work shop. It is primarily designed for bending. The bend has been made with the help of punch which exerts large force on the work clamped on the die. The sheet metal cutting process is a main part of the all industries.

II. IMPROVISATION

When we are using automation, then we reduced Sheet metal feeding problems to workers. In general traditional cutting process there is manual feeding process. In this system we replaced manual feeding to automatic feeding.

III. OBJECTIVE

The main objective of the present project is to automate the system so that the cutting operation can be done

with high accuracy. To achieve this, microcontroller based system is incorporated in this project. This system controls the feed and performs the cutting action via pneumatic means.

IV. LITERATURE REVIEW

1- Niranjan Karkera, Ganesh Kalagi

It is observed that the pneumatic cutting is very cheap as compared to hydraulic cutting machine. The range of the cutting thickness can be increased by using high pressure compressor and more hardened blades

2- Parth A Prajapati, Mirant G Patel

We developed a branch and bound approach which is coupled with quick, effective bounds to optimize the “Pneumatic cutting machine “which serves the cutting of die blades for punching die within a manufacturing cell. The design of control architecture was an important aspect of study because a strong interaction between the many different parts was needed.

3- Madhu Kumar V, Arun Kumar N

Now we know that Pneumatic cutting and bending machine is very cheap as compared to hydraulic cutting and bending machine. The range of the cutting and bending thickness can be increased by arranging a high pressure compressor and installing more hardened blades. This machine is advantageous to small sheet metal cutting and bending industries as they cannot afford the expensive hydraulic cutting and bending machine. Use of aluminium is increased now days in many industries like automobile, packaging, medical etc.

4 . Vallance and Matlock (1992)

Studied the friction behavior of zinc-based coated sheet steels and laboratory scale friction analysis techniques that involve sheet sliding over cylindrical dies. Wenzloff et al (1992) introduced a new test procedure for the bending under tension friction test.

5. Mai Huang and Gardeen

presented a literature review of the springback of doubly curved developable sheet metal surfaces and provided a bibliography on the springback in sheet metal forming. Reviewing the literature, it is found that researchers have been studying the phenomenon of springback for nearly six decades. There have been diverse efforts to evaluate and/or decrease springback in the sheet metal forming industry for a long time

6. Perduijn and Hoogenboom (1995)

Derived a simple explicit bending couple curvature relation for small and larger curvatures and they verified the model with experimental results. A simple approach for calculating bendability and springback in bending based on the normal anisotropic value, strain hardening exponent and sheet thickness has been presented as described elsewhere by Daw Kwei Leu (1997).

V. DESIGN OF FRAME & BLADE SET UP.

The frame is made up of mild steel material. Because, mild steel is readily available in market and is economical to use. It has good mechanical properties such as high ductility and high toughness. Mild steel has carbon content ranging from 0.15% to 0.25%. The ultimate strength and compressive of this steel increases with increase in the carbon content.

The shearing blade is made up of high speed steel material. The blade has to withstand the high cutting forces and this can be achieved by using high speed steel as a blade material. High speed steel offers reliable toughness and it retains good wear resistance. A typical composition is: 18% of tungsten, 4% of chromium, 1% of vanadium, 0.7% of carbon and the rest is iron.



Fig : Actual Design of Frame

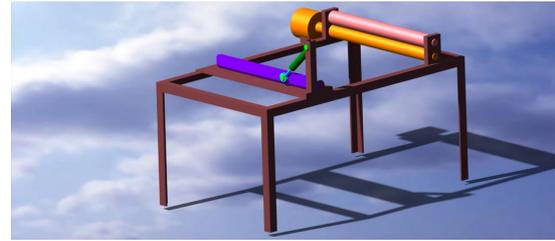


Fig : CAD Model of Frame

1. SHEET METAL

Sheet metal is metal formed by an industrial process into thin, flat pieces. Sheet metal 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; extremely thin sheets are considered foil or leaf, and pieces thicker than 3 mm are considered plate steel or "structural steel."

2. AIR COMPRESSOR

An electric compressor is a device that converts power (using an electric motor, diesel or gasoline engine, etc) into potential energy stored in pressurized air. An air compressor of 12 bars pressure. 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 compressor shuts off. The energy contained in the compressed air can be used for a variety of applications. As the compressed air is released from the cylinder, the tanks depressurize. When tank pressure reaches its lower limit, the air compressor turn on again and depressurizes the tank.



Fig: Air Compressor

3. DC MOTOR

An electric motor is a machine which converts electrical energy to mechanical energy. Its action is based on the principle that when a current carrying conductor is placed in a magnetic field, it experiences a magnetic force whose direction is given by Fleming's left hand rule. When a motor

is in operation, it develops torque. This torque can produce mechanical rotation.

4. ARDUINO

Arduino is open source hardware and software company, project and user community that designs and manufactures single board microcontrollers and microcontroller’s kits of building digital devices and interactive objects that can sense and control objects in the physical and digital world.



5. Relay

A relay is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch, but other operating principles are also used, such as solid-state relays. signal. The first relays were used in long distance telegraph circuits as amplifiers: they repeated the signal coming in from one circuit and re-transmitted it on another circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operations. Relays are used where it is necessary to control a circuit by a separate low-power signal, or where several circuits must be controlled by one

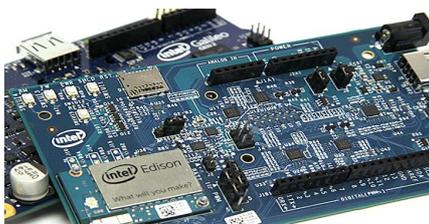


Fig : 2 Relay Module

6. FLEXIBLE HOSES

The flexible hoses connect the solenoid valve and the cylinder block. Hoses are made of in layer of elastomer (or) synthetic rubber and braided fabric which takes up the higher pressure. If the hose is subjected to rubbing, it should be enclosed in a protective sleeve. Hoses can be used in water or other liquid environments or to convey air or other gases. Hoses are used to carry fluids through air or fluid environments, and they are typically used with clamps, spigots, flanges, and nozzles to control fluid flow.



Fig : Flexible Hoses

7. SOLENIOD VALVE

A solenoid valve is an electromechanical devices in which the solenoid uses an electric current to generate magnetic field and thereby operate a mechanism which regulates the opening of the fluid flow in a valve. The direction control valve is used to control the direction of air flow in the pneumatic system. The figure shows electrically controlled solenoid valve.



Fig :Solenoidal Valve

8. PNEUMATIC CYLINDER

The cylinders are the devices which use the power of compressed air to produce force in a reciprocating linear motion. In this project, double acting pneumatic cylinder in used as shown in figure. It develops pressure in both extend and retract strokes. The moving member inside the cylinder is piston which moves forward and backward due to the high

pressure of air. The cylinder top and lower plate are flanged together by means of bolts and nuts. The bottom of the cylinder is also flanged with end covers for the movement of the piston in reciprocating manner.



Fig : Pneumatic cylinder (Double Acting)

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VI. RESULT

As mentioned above, in general traditional cutting processes feeding of sheet metal is very fatigue to the worker. Because of manual feeding there are chances of failure of cutting process. In this system we employed Arduino microcontroller, DC motor and solenoid valve. By using these devices we made feeding is totally automatic. Because of automation productivity increases, less time required for the process and easily handling process.

VII. CONCLUSION

“Analysis & Fabrication of Pneumatic Sheet metal Automatic cutting & feeding machine”. The machine is for sheet metal industry can be used into multiple machines and should be used as straight cutting machine. This machine is simple to maintain, easy to operate. Hence, we tried out.

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