

DESIGN AND DEVELOPMENT OF PNEUMATIC METAL SHEET CUTTING MACHINE

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ABSTRACT

This machine is for sheet metal industry and can be made into multiple machine and should be used as circle cutting cum straight cutting machine. The machine is simple to maintain easy to operate. Hence, we tried out hands on Pneumatic Cutting Machine.

In cutting operation as the punch descends upon the metal, the pressure exerted by the punch first cause the plastic deformation of the metal. Since the clearance between the punch and the die is very small, the plastic deformation takes place in a localized area and the metal adjacent to the cutting edges of the punch and die edges becomes highly stressed, which causes the fracture to start on both sides of the sheet as the deformation progresses.

KEY WORDS: *Pneumatic Cylinder, Cutting blade, Solenoid Valve, 5/2 DCV, Compressor, Flexible hose*

1. INTRODUCTION:

Pneumatics, from the Greek (pneumatics, coming from the wind) is the use of pressurized gases to do work in science and technology.

Pneumatics was first documented by Hero of Alexandria in 60 A.D., but the concept had existed before then. Pneumatic products represent a multi-billion dollar industry today. Pneumatic devices are used in many industrial applications. Generally appropriate for applications involving less force than hydraulic applications, and typically less expensive than electric applications, most pneumatic devices are designed to use clean dry air as an energy source. The actuator then converts that compressed air into mechanical motion. The type of motion produced depends on the design of the actuator. Pneumatics is employed in a variety of settings. In dentistry applications, pneumatic drills are lighter, faster and simpler than an electric drill of the same power rating (because the prime mover, the compressor, is separate from the drill and pumped air is capable of rotating the drill bit at extremely high rpm). Pneumatic transfer systems are employed in many industries to move powders and pellets. Pneumatic tubes can carry objects over distances. Pneumatic devices are also used where electric motors cannot be used for safety reasons, such as mining applications where rock drills are powered by air motors to preclude the need for electric motors deep in the mine where explosive gases may be present. Pneumatic cylinders are generally less expensive than hydraulic or electric cylinders of similar size and capacity.

1.1 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.

1.2 Types of cutting Machine:

Cutting machines are classified according to the following:-

1. Hydraulically operated
2. Rack and pinion operated
3. Spring operated

1.3 Brief description of all the types are as follows.

1) Pneumatically 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.

2) Hydraulically 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.

3) Rack and pinion operated:-

Here the lowering and the raising of the header is 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. Since the machine is robust and requires large pressure, hence it is not suitable.

4) 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 is 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.

1.4. 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.

2. 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.

4. DESCRIPTION OF EQUIPMENT PNEUMATIC CYLINDER:

4.1 PNUMATIC 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.

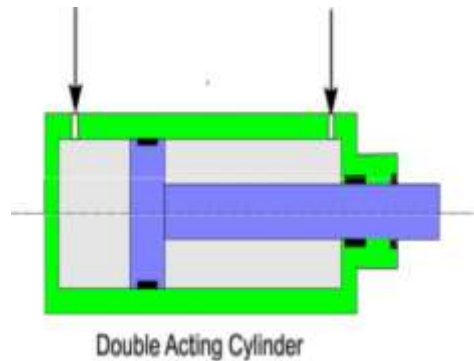


Fig 4.1 Pneumatic cylinder

4.2 Cutting Blades

A blade is used to cut the sheet metal in a desired dimension. Here we are using high speed steel blades to cut the sheet metal. Cutting blades are made of WPS metal welding process steel.



Fig 4.2: Cutting blade

4.3 Compressor

Pneumatic systems operate on a supply of compressed air, which must be made available in sufficient quantity and at a pressure to suit the capacity of the system. When pneumatic system is being adopted for the first time, however it will indeed be necessary to deal with the question of compressed air supply. The key part of any facility for supply of compressed air is by means using reciprocating compressor. A compressor is a machine that takes in air, gas at a certain pressure and delivered the air at a high pressure.

Compressor may be classified in two general types.

1. Positive displacement compressor.
2. Turbo compressor.

Positive displacement compressors are most frequently employed for compressed air plant and have proved highly successful and supply air for pneumatic control application.

The types of positive compressor are:

1. Reciprocating type compressor
2. Rotary type compressor.



Fig 4.3: Compressor

4.4. Flexible Hose

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.

**Fig 4.4: Flexible hoses**

5. 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.



6. ADVANTAGE:

1. Freely available from the atmosphere.
2. Explosive proof. No protection against explosion required.
3. Easily transportable in the vessels and pipes.
4. No return lines are required.
5. Clean system. It has self-cleaning properties.

7. CONCLUSION:

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. We know that the “Pneumatic cutting machine” developed by us cannot be directly used on the factory floor because of some limitations. But we will correct the drawbacks in this system & it will be used in industries. So we are satisfied with our project.

8. ACKNOWLEDGEMENT:

Project work, lays the foundation of student’s career today. The satisfaction that

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