

# A REVIEW PAPER ON PNEUMATIC OPERATED SHEET METAL SHEARING MACHINE

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## ABSTRACT

*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 [2]*

**Keyword:-** Pneumatic, SPM, etc.

## 1. INTRODUCTION

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

Types of shearing Machine:[3]

Shearing machines are classified according to the following:-

- 1) Pneumatically operated
- 2) Hydraulically operated
- 3) Rack and pinion operated
- 4) Spring operated

Brief description of all the types is 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]

#### 1.1 Pneumatic cylinder

Pneumatic cylinders or air cylinders are mechanical devices used to impart a force from a fluid, typically compressed air.

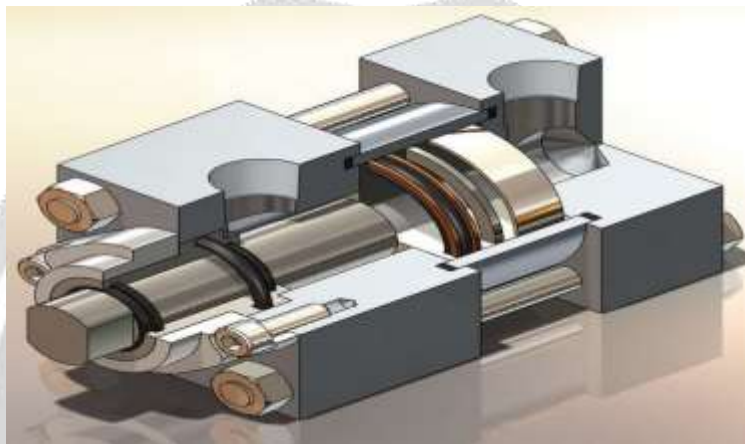


Figure 1. Pneumatic Cylinder [1]

A typical pneumatic cylinder consists of a piston, piston rod, and a body or tube. Compressed air enters at one end of the tube, imparting force on the piston, which is then displaced (moves) in order to balance the force exerted on the piston. Air cylinders, or actuators as they are also called, are available in a variety of sizes, shapes, and have varying strokes. Typical cylinder sizes range from a small 2.5mm air cylinder, which might be used for picking up a small transitory or other electronic

## 2. PROBLEM DEFINATION

In this work we will planned to create SPM (Special Purpose Machine) for sheet metal cutting operation. Generally in an industry conventional hydraulic machines are used for same operation which is costliest and bulky. Sheet metals are used in

1. Car bodies
2. Airplane wings
3. Medical tables
4. Roofs for buildings (Architectural) and many other things
5. Sheet metal of iron and other materials with high magnetic permeability, also known as laminated steel cores, has applications in transformers and electric machines.

Historically, an important use of sheet metal was in plate armor worn by cavalry, and sheet metal continues to have many decorative uses, including in horse tack Here we are planning to use double acting cylinder for the operation.[4] We are doing design calculation then we are going for manufacturing and experimentation.

Here we have used double acting cylinder. It is the pneumatic actuator, which is actuated using compressed air. The Force exerted by the compressed air moves the piston in two directions in a double acting cylinder. In principle, the stroke length is unlimited, although buckling and bending must be considered before we select a particular size of piston diameter, rod length and stroke length. [1-2]The double acting cylinder consists of

- 1) Cylinder tube

- 2) Piston unit
- 3) Double cup packing on piston, rod packing of O rings
- 4) Bronze rod guide
- 5) Piston rod
- 6) End covers (flanges)
- 7) Port connection
- 8) Cushion assembly.

### 3. PROPOSED WORK

To prepare any machine part, the type of material should be properly selected, considering design, safety and following points:- The selection of material for engineering application is given by the following factors:-[4]

- 1) Availability of materials.
- 2) Suitability of the material for the required components.
- 3) Suitability of the material for the desired working conditions.
- 4) Cost of the materials.

In addition to the above factors the other properties to be considered while selecting the material are as follows:-

- 1) Availability of materials.
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- 3) Suitability of the material for the desired working conditions.
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In addition to the above factors the other properties to be considered while selecting the material are as follows:-

Physical properties:-

These properties are color, shape, density, thermal conductivity, electrical conductivity, melting point etc.

Mechanical properties:-

The properties are associated with the ability of the material to resist the mechanical forces and load.

The various properties are:-

- i) **Strength:** It is the property of material due to which it can resist the external forces without break-ing or yielding.
- ii) **Stiffness:** It is the ability of material to withstand the deformation under stress.
- iii) **Ductility:** - It is the property of material due to which it can be drawn into wires under a tensile load.
- iv) **Malleability:** It is the property of material which enables it to be rolled into sheets.
- v) **Hardness :** It is the property of material to resist wear, deformation and the ability to cut another material.
- vi) **Resilience:** It is the ability of the material to store energy and resist the shock and impact loads.
- vii) **Creep:** It is the slow and permanent deformation induced in a part subjected to a constant stress at high temperature. We have selected the material considering the above factors and also as per the availability of the material.

Following are the procedure we work flow for our project in stage II to manufacture SPM for Pneumatic Operated Sheet Metal Shearing Machine.

1. The cylinder will manufactured from aluminum solid bar with central bore on lathe machine. It is then made smooth internally using method of honing and lapping. As it contains piston and piston rod, which reciprocates to and fro with the application of high pressure air. The piston is fitted with the piston ring which is made of Teflon rubber to make perfect compression of the air. 5/2 Direction control foot operated valve.[5]

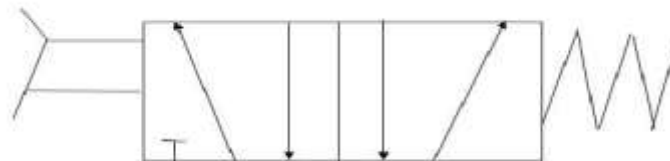


Fig. 2 5/2 control valve [1]

2. To generate the hydraulic circuit diagram for the above operations.

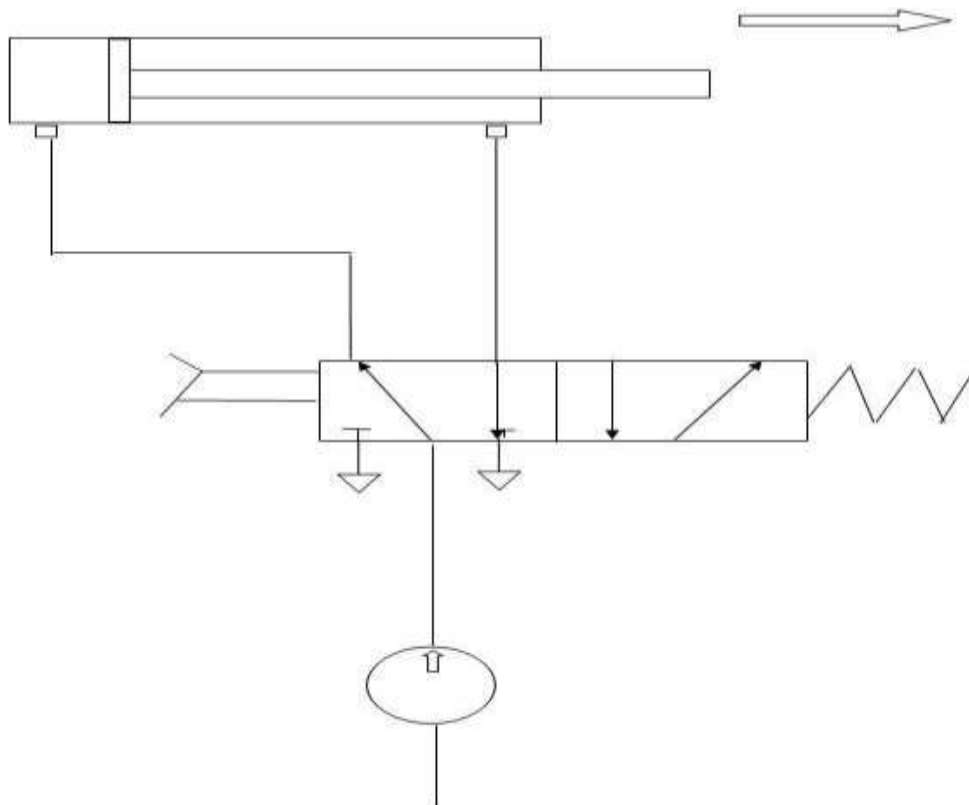


Fig. 3 Hydraulic circuit diagram for neutral position [1]

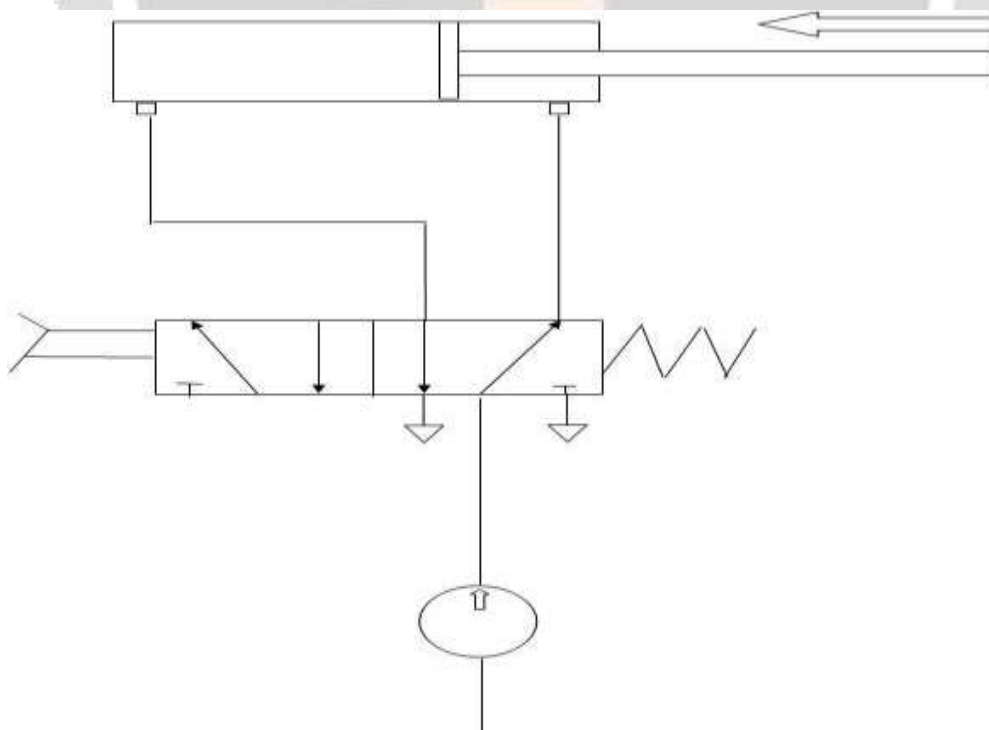


Fig. 4 Hydraulic circuit diagram for working condition [1]

3. In stage II we will plan to do design calculation followed by manufacturing and experimentation

Following path is followed for the proceeding project work for project stage II

Table 2 Proposed work for project stage II

Sr. No.	Month	Task to be done
1	November 2019	Review research paper proceeding and paper publication on project stage I
2	December 2019	Design calculation of different part of SPM.
3	January 2020	FEA analysis and simulation with the design calculation,
4	February 2020	Manufacturing of SPM and experimental calculations.
5	March 2020	Report writing with guidance from project guide
6	April 2020	Report writing with guidance from project guide and final presentation preparation and publishing research paper 2 on Project Stage II.

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