Pneumatic Sheet Bending Machine

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Abstract- *The paper deals with manufacturing or bending of sheet metal by using power operated sheet metal bending machine. Especially discussion made the productivity analysis of manually or power operated sheet. Considering manual operation is replaced by power operated devices .It also gives information about limitation of manually operated sheet metal bending machine and power operated sheet metal bending machine.*

Keywords- Pneumatic System, Direction Control Valve, Compressor, Sheet Cutter, Bending Punch & Die

I. INTRODUCTION

The Automation of Metal Pneumatic Sheet Bending Machine Mechanical Project describes the bending machine which is an essential tool of a machine used to shop sheet metal work. This is generally made for the bending of V-die. The bend is created by making use of punch that applies much more force on the die over the work clamped. The bending machine is created in such a manner that these functions automatically. Automation is obtained by making use of electro-pneumatic systems. It possesses large resistance for the corrosion than various other metals and obligated to protect deliberately with the tenacious and thin film of oxide that produces on its surface

Fig 1.1 Pneumatic Sheet Bending Machine

1.1 HISTORY

Pneumatics has long since played an important role as a technology in the performance of mechanical work. It is also being used in the development of automation solutions. Pneumatic systems are similar to hydraulic systems but in these systems compressed air is used in place of hydraulic fluid

A pneumatic system is a system that uses compressed air to transmit and control energy. Pneumatic systems are used extensively in various industries. Most pneumatic systems rely on a constant supply of compressed air to make them work. This is provided by an air compressor. The compressor sucks in air from the atmosphere and stores it in a high pressure tank called a receiver. This compressed air is then supplied to the system through a series of pipes and valves.

The word 'Pneuma' means air. Pneumatics is all about using compressed air to do the work. Compressed air is the air from the atmosphere which is reduced in volume by compression thus increasing its pressure. It is used as a working medium normally at a pressure of 6 kg/sq mm to 8 kg/sq mm. For using pneumatic systems, maximum force up to 50 kN can be developed. Actuation of the controls can be manual, pneumatic or electrical actuation. Compressed air is mainly used to do work by acting on a piston or vane. This energy is used in many areas of the steel industry.

Pneumatic machines need five basic components to make, store, control, move, and use compressed air:

1. A compressor—makes air. 2. A reservoir (or receiver)—stores air. 3. One or more valves—control air. 4. A circuit—moves air between the other components. 5. An actuator or motor—uses air to do something.

Pneumatic devices get all their power from the energy in the compressed air they use, so you can probably see straight away that they need at least two key components: something to compress the air (the compressor) and something that uses compressed air to lift, move, or hold an object (the actuator). We also need a pipe or network of pipes (the circuit) to get air from the compressor to the actuator.

1.2 LITERATURE REVIEW

Sheet metal bending is one of the most widely applied sheet metal forming operations. The understanding of

the bending mechanics is aimed at obtaining two kinds of information important for industrial applications. The first one is the spring back prediction for die design and shape control. The second is an estimation of the bend force for selection of press capacity, strength analysis and design of dies. 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. Mai Huang and Gardeen (1994) presented a literature review of the spring back 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 spring back for nearly six decades. There have been diverse efforts to evaluate and/or decrease spring back in the sheet metal forming industry for a long time. 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 spring back 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).

You-Min Hang and Daw-Kwei leu (1998) described the effects of process variables like punch radius, die radius, punch speed, friction coefficient, strain hardening exponent, normal anisotropy on V-die bending process of steel sheet. Sanchez (1999) focused on a systematic analysis of testing equipment as a measurement system of the friction phenomena on sheet metal under plane strain. It provides experimental references in order to optimize the usage of lubricants and sheet metal. Weilong Hu (2000) proposed anisotropy hardening models with simple loading conditions that include exponential hardening model, linear hardening model and multi linear hardening model. Samuel (2000) analyzed the spring back in axisymmetric U-bending processes with a finite element program and discussed the effect of tool geometry and blank holder force on the final shape after spring back. Aleksy et al (2001) conducted experiments on spring back for dual phase steel and conventional high strength steel for a hat channel section with varying cross sections. They described the methodology of experiments and discussed spring back

II. WORKING

The pneumatic sheet bending machine includes a table with support arms to hold the sheet, stops or guides to secure the sheet, upper and lower straight-edge blades, a gauging device to precise position the sheet. The table also includes the two- way directional valve. The twoway directional valve is connected to the compressor. The compressor has a piston for a movable member. The piston is connected to a crankshaft, which is in turn connected to a prime mover (electric motor, internal combustion engine). allow air to enter and exit the chamber. When the compressor is switched ON, the compressed air flows to the inlet of the pneumatic cylinder. The sheet is placed between the upper and the lower blade. The lower blade remains stationary while the upper blade is forced.

The pneumatic bending is used for bending up to 18 gauge sheet metal with low pressure. In the pneumatic press the main source given here is compressed air or pressurized air with the help of compressor. The air in the compressor cylinder is passed to the double acting cylinder through the control valves. Here we consist of two control valves one is flow control valve and another one is direction control valve. When the compressed air is passed to the flow control valve, the speed of movement of piston is controlled by adjusting the knob. Then the air goes to the direction control valve, this is used to up/down movement of the double acting pneumatic cylinder. The cylinder piston rod is connected to the top fixture. A bottom fixture is fixed on the base plate by using bolts and nuts

III. CONSTRUCTION

Raw material used :- 1. Mild steel bars for base frame 2. 35c8 materials for shearing blades 3. Cylinder fittings like fork end, base plates, support links. 4. Angle section for blade fitting 5. Connecting link 6. Blade link

Ready items used:- 1. Pneumatic double acting cylinder. 2. Direction& flow control valves 3. Pneumatic pipes 4. Bolts & nut 5. Antirust coat & paint

Machines & tools used:- 1. Cutting machine 2. Hacksaw cutting machine 3. Sensitive drilling machine 4. Electric arc welding machine 5. Table grinder 6. Hand grinder 7. Tap & tap hole

IV. COMPONENTS

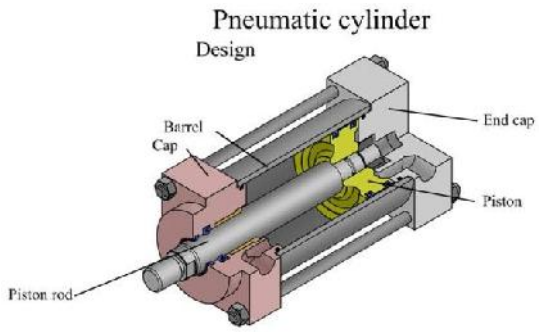

Fig 4.1 Pneumatic Cylinder

Pneumatic cylinders (sometimes known as air cylinders) are mechanical devices that use the power of compressed gas to produce a force in a reciprocating linear motion. In the pneumatic cylinder, compressed air is used as a working fluid and converts it into kinetic energy as the air expands in an attempt to reach atmospheric pressure. This air expansion forces a piston to move in the desired direction.

A pneumatic cylinder is a mechanical device that converts compressed air energy into a reciprocating linear motion. A double-acting cylinder uses compressed air to move a piston in and out, while a single-acting cylinder uses compressed air for one-way movement and a return spring for the other. They have numerous accessories, like sensors to detect the position of the piston and different mounting accessories

DIRECTION CONTROL VALVE

Fig 4.2 Direction Control Valve

The directional valve is one of the important parts of the pneumatic system. Commonly known as DCV, this valve is used to control the direction of airflow in the pneumatic system. The directional valve does this by changing the position of its internal movable parts. This valve was selected for speedy operation and to reduce the manual effort and also for the modification of the machine into an automatic machine by means of using a solenoid valve.

3/2-way valve has three ports and two positions that can be driven pneumatically, mechanically, manually or electrically via a solenoid valve. They are used, for example, to control a single-action cylinder, driving pneumatic actuators, blow-off, pressure release and vacuum applications. A valve is used to fill the cylinder, and also to exhaust it afterwards, so that a new working stroke can be realized. Therefore, a valve with two ports would not be adequate. Venting requires a third port. There are two kinds of 3/2 valves: mono-stable and bi-stable.

Bending Punching And Die

Fig 4.3 Bending Punching And Die

To perform bending operation, the bending punch and ideas to replace with cutter and then after we can perform bending operation. The bending angle is 90 and as per the requirement in the future, we can change the angle of bending.

Top tools and bottom tools, (punches and dies respectively) work in unison at the business end of your Press Brake. They work by folding your work piece between a matching punch and die and applying force to bend the material (typically sheet metal and metal plate) in to a predetermined shape.

Pneumatic Tube

Fig 4.4 Pneumatic Tube

Pneumatic tubes (or capsule pipelines, also known as pneumatic tube transport or PTT) are systems that propel cylindrical containers through networks of tubes by compressed air or by partial vacuum. They are used for

transporting solid objects, as opposed to conventional pipelines which transport fluids. In the late 19th and early 20th centuries, pneumatic tube networks gained acceptance in offices that needed to transport small, urgent packages, such as mail, other paperwork, or money, over relatively short distances, within a building or, at most, within a city. Some installations became quite complex, but have mostly been superseded. However, they have been further developed in the 21st century in places such as hospitals, to send blood samples and the like to clinical laboratories for analysis.

Pneumatic Compressor

Fig 4.5Air 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

V. APPLICATION

- This machine is very useful for small scale industries
- These machines used to cut the rolled sheet metal
- All industrial application
- Sheet Metal Fabrication
- FOR Paper cutting
- For sheet cutting
- For stamping operating

VI. ADVANTAGES

- The pneumatic is more efficient in the technical field.
- A quick response is achieved.
- Easy maintenance and repair. Low investing cost.
- 5 Continuous operation is possible without stopping.
- Compact size and less floor space are used.
- All movements are pneumatically operated.
- The optional solution of operation is the Electrical control panel.
- Ragged construction to suit in highly acidic atmosphere & high temperature.
- All pneumatic actuators are S.S. to suit a corrosive atmosphere.
- Air is available everywhere

VII. DISADVANTAGES

- Silencer must be used while compressing the air
- High torque cannot be obtained
- Load-carrying capacity is low
- Sheet more than 2 mm thickness cannot cut easily
- Compressed air is must
- Foundation is required also safety major must be taken

VIII. FUTURE SCOPE

Arios Man is always trying to develop more and more modified technique with increasing the aesthetic look and economic considention. Hence there is always more and more scope. But being the Diploma Engineers and having the ability to think and plan: But due to some time constraints, and also due to lack of funds, we only have thought and put in the report the following future modifications

1. It can be made hydraulically power operated by Installing the gear oil pump at the place of air compressor and pneumatic cylinder arrangement.
2. It can be made rack and pinion operated or spring and lever operated, by replacing the pneumatic circuit by rack and the pinion arrangement by the square threaded screw and nut arrangement.
3. The place where there is scarcity of the electricity the electric motor operate compressor is replaced by an LC. Engine insted compressor.

Thus in future there are so many modifications, which we can make to survive the huge global world of competition.

IX. CONCLUSION

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.

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The range of the cutting thickness can be increased by arranging a high pressure compressor and Installing more hardened blades. This machine is advantageous to small sheet metal cutting industries as they cannot afford the expensive hydraulic shearing machine.

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