Middle-East Journal of Scientific Research 20 (3): 388-390, 2014
ISSN 1990-9233

DOI: 10.5829/idosi.mejsr.2014.20.03.11355

Design of Bending Fixture Using Pneumatics

R. Gopinath

Department of Mechanical Engineering,
Bharath University, Selaiyur, Chennai, Tamilnadu, India

Abstract: The project deals with design and fabrication of bending fixture that uses pneumatics, for bending aluminum sheets. The fixture uses three pneumatic cylinders, which enables a more accurate bending than the conventional ones. Here, with the first cylinder clamping the work piece, the other two cylinders are used respectively for initial forming to bend up to some angle and final forming to complete the work. By using pneumatic power, the human effort is reduced along with saving time. A cylinder pressure of 8 bars is sufficient for this application of bending sheets up to 5 millimeters thickness. Usage of low pilot valves for actuating the direction control valves eliminate the difficulties encountered while using mechanical actuators. The signal breaker used eliminates the need for timers. *For* bending aluminum sheets up to 5 millimeters thickness a fixture configuration is developed, with three pneumatic cylinders. With proper calculations the circuit is designed. The various circuit components have been purchased and the fixture is fabricated. The fixture is tested at the lab with specimen work pieces and is found to be operating successfully. Thus a novel and useful fixture has been successfully developed.

Key words: Fixture has been successfully developed · By using pneumatic power · While using mechanical actuators · Millimeters thickness a fixture configuration

INTRODUCTION

Pneumatics is a branch of the Fluid power system, which uses air as the fluid for transmitting the power from one position to the other. Pneumatics is well suited for applications that require quick response. Air is used as the fluid because it is safe, less expensive and readily available. Air can be inducted and exhausted directly to the atmosphere and a return line is not necessary as with hydraulics. The main advantage of a pneumatics is the elimination of many components like gears. The construction and maintenance cost is low. The air is highly compressible due to which pneumatic system acts as a spring. Pneumatic system follows Pascal's law [1].

Pneumatic devices are used in many industrial applications. It is also widely used for material handling operations, high speed clamping and in robot power drives for arms and grippers [2].

Pneumatic system is typically less expensive than e lectric 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 [3].

In pneumatic systems, compressors are used to compress and supply the necessary quantity of air. Basically a compressor increases the pressure of a gas by reducing its volume as described by the gas law. The pressurized air can be piped from one source to various locations. The air is piped to each circuit through an air filter. The air then flows through the pressure regulator and also through a lubricator. The air then finally sent through the mufflers [4].

A fixture is a device used for holding the workpiece during machining operations. It is fastened to the machining table.

Some of the components used are:

- Air compressor
- Double acting, power cylinder of bore 70mm and stroke length 50mm.
- Double acting, power cylinder of bore 70mm and stroke length 75mm
- Flange mounting plates
- Pilot operated Direction control valve (5 Ports 2 Position)

Corresponding Author: R. Gopinath, Department of Mechanical Engineering,
Bharath University, Selaiyur, Chennai, Tamilnadu, India.

- Low pilot, spring return direction control valve (3 ports 2 position)
- Push button spring return direction control valve (3 ports 2 position)
- Silencer cum flow control valve

Functions of the Components:

Low Pilot Valves: These valves play the major part of controlling the direction control valve. These valves shift the position of the direction control valve (i.e.) from left position to right position of the direction control valve and vice versa.

Signal Breaker: The signal breaker is used mainly to delay the motion of the cylinders. It works only at high pressure.

Push Button: The push button is a device which initiates the whole process.

Foot Mounting Brackets: The cylinders are fixed rigidly on to the table by using the foot mounting brackets.

Construction: There are two lines constituting the connection between the cylinders and the valves. The first one is the main line which is directly linked with the compressor and the other is the pilot line which is relatively smaller in cross sectional area. The cylinders are fixed to the table with the use of the foot mounting brackets [5].

Working: Initially the object to be bent is placed next to the dye. When the compressor is switched on, the air from the compressor is sent to five ports DCV and to low pilot DCV by using straight connectors. There are totally 3 cylinders used, the first cylinder is called clamping cylinder, the second cylinder is called initial forming cylinder and the third cylinder is called final forming cylinder.

The working sequence is $A^+B^+B^-C^+C^-A^-$: The air from compressor is sent to the valves. When the push start button P is pressed the direction control valve 'a' of cylinder A shifts to right position and starts to extend to clamp the workpiece. During the forward stroke of the piston in cylinder A, the air is bleed off using a t-connector and is sent to a low pilot valve Q. The low pilot valve Q which is normally open in ordinary condition changes its position to closed position. After the completion of forward stroke of cylinder A, the low pilot valve Q switches back to open position due to spring actuation. The low pilot valve Q is connected to the direction control valve 'b' of cylinder B through a signal breaker. Since the signal breaker works at high pressure, the whole cycle works at a pressure more than 6 bars. Due to sudden flow of air from low pilot valve Q to the direction control valve 'b' shifts the latter position from left to right. The Cylinder B extends forward to perform the initial forming process. During the Forward stroke the low pilot valve R changes its position from open to closed position. After the completion of the forward stroke of cylinder B, the low pilot valve R shifts back to open position. When air flows through the low pilot valve R to the direction control valve 'b', the direction control valve 'b' shifts back from right actuation to left actuation. Then the retraction stroke of the cylinder B takes place. During the retraction motion of cylinder B, the low pilot valve S connected along the line changes its position to close. After the completion of the return stroke the low pilot valve sends pilot signal to the direction control valve 'c'. This shifts the direction control valve 'c' position to right providing the forward motion of piston of cylinder C. The workpiece is completely formed at the end of the forward stroke The low pilot valve T that is fitted on the drain line of the cylinder C shifts its position from open to closed one. After extending the low pilot valve T regains its open position which allows the air to flow through the low pilot valve T and reach the direction control valve 'c' and direction control valve 'a'. The left actuation of the direction control valve 'c' and 'a' takes place the piston of both the cylinders A and C retracts to complete one cycle. Now the work piece is removed.

CONCLUSION

The design and fabrication of bending fixture using pneumatics was successfully done. The pneumatic components are fitted without any leakage and they are successfully tested. This project can be further extended for bending materials in industries with same circuit by changing the cylinder dimensions [6].

REFERENCES

1. Manual, Festo, Festo company.
2. Srinivasan, R., 2004. Hydraulic and Pneumatic controls, Vijay Nicole imprints Pvt Ltd.

3. Johnson, Janco, L., 2003. Introduction to fluid power, Eswar Press.
4. Parr, Andrew, 1999. Hydraulics and Pneumatics(HB), Jaico Publication House.
5. 199, 9Anthony x, 1980. Fluid power with application, Prentice Hall.
6. Peace, Dudleyt A and John J Pippenger, 1987. Basic Fluid Power, Prentice Hall.