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Research Paper

Fabrication of U-Type, V-Type, L-Type Angle Bending Machine

Engineering

KEYWORDS : Bending, Production, Equipment, Frame

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ABSTRACT

In this paper bending of U shaped metal rod is carried with the help of pneumatic cylinder arrangement. This method is very useful in industries to convert the lengthiest metal rod to the u shaped type. Here the main aim of the our project is reduce the man power, applying constant force at all time, automating the process and also increase the rate of production. The project is designed by following equipment compressor, control unit, Solenoid valve, Pneumatic Cylinder and Mechanical model.

1. INTRODUCTION

Pneumatics is a section of technology that deals with the study and application of pressurized gas to produce mechanical motion.

Pneumatic systems are used extensively in industry, and factories are commonly plumbed with compressed air or compressed inert gases. This is because a centrally located and electrically powered compressor that powers cylinders and other pneumatic devices through solenoid valves can often provide motive power in a cheaper, safer, more flexible, and more reliable way than a large number of electric motors and actuators. Here in this project, we are using this technology to stamp on a sheet metal which is placed in between the dies to get the required profiles.

WORKING PRINCIPLE

The working of the process is fully pneumatic operated where the air is the working medium. In this unit compressor is used to supply the compressed air at certain pressure. This pressurized air is passed to the solenoid valve. The solenoid valve is controlled by control unit. This solenoid valve is used to control the direction of flow of air to the pneumatic cylinder. In this pneumatic cylinder the piston rod actuates due to the pressure. At the end of piston rod bending tool is attached. So that tool bends the rod into required U shape. Thus the work piece clamped on the frame is bending due to the reciprocating motion of the bend.

APPLICATIONS

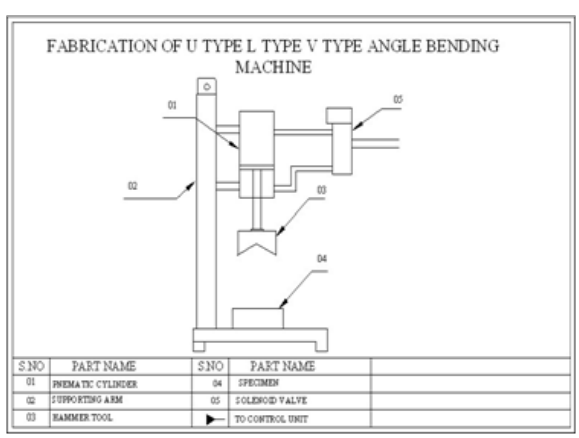
- Steel plants
- Toy manufacturing companies
- Automobile industries
- PVC door manufacturing companies

ADVANTAGES

- Quick response .
- Simple in construction easy to maintain and repair.
- Cost of the unit is less when compared to other systems.
- Comparatively the operation cost is less.
- Continuous operation is possible without stopping.
- Clean work space when compared to hydraulics.

LIMITATIONS

- Only sheet can be folded (For metals).
- Air leakage will reduce the efficiency of the system.
- Requires only compressed air



INTRODUCTION TO PNEUMATICS

In engineering field may Machines make use of a fluid or compressed air to develop a force to move or hold an object

A system which is operated by compressed air is known as Pneumatic System. It is most widely used the work Piece turning drilling sawing etc.

By the use of Pneumatic System the risk of explosion on fire with compressed air is minimum high working speed and simple in construction.

PNEUMATIC COMPONENTS

In engineering field, many machines make use of fluid for de-

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veloping a force to move or hold an object. A number of fluid can be used in devices and system. Two commonly used fluids are oil and compressed air. A system which is operated by compressed air. A system which is operated by compressed air is know as pneumatic system.

AIR COMPRESSOR

Compressor is a device which gets air fro the atmosphere and compresses it for increasing the pressure of air. Thus the compressed air. Thus the compressed air used for many application.

The compression process requires work in put. Hence a compressor is driven by a prime mover. Generally an electric motor is used as prime mover. The compressed air from compressor is stored in vessel called reservoir. Fro reservoir it be conveyed to the desired place through pipe lines.2. FILTER

In pneumatic system, an air filter is used to remove all foreign matter. An air filter dry clean air to flow without resistance various materials are used for the filter element. The air may be passed thorugh a piece metal, a pours stone felt resin impregnated paper. In some filters centrifugal action or cyclone action is used to remove foreign matters.

3. PRESSURE REGULATOR

Constant pressure level is required for the trouble free operation of a pneumatic control., A pressure regulator is fitted downstream of the compressed air filter. It provides a constant set pressure at the outlet of the outlet of the regulator. The pressure regulator is also called as pressure reducing valve or pressure regulating valve.

4. LUBRICATOR

The purpose of an air lubricator is to provide the pneumatic components with sufficient lubricant. These lubricants must reduce the wear of the moving parts reduce frictional forces and protect the equipment from corrosion.

Care should be taken to ensure that sufficient lubrication is provided. But excessive lubrication should be avoided.

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5. FLR Package (or) FRL Package

The air service unit is a combination of following units.

1. Compressed air filter
2. Compressed air regulator
3. Compressed air lubricator

Air Filter, regulator and lubricator are connected together with close nipples as one package. This unit is know as FLR (Filter, regulator, lubricator.)

6. PRESSURE CONTROL VALVE :

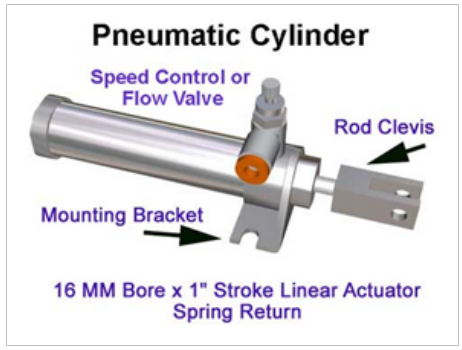
Each hydraulic system is used to operate in a certain pressure range. Higher pressure causes damage of components. To avoid this pressure control valves are fitted in the circuits.

7. Direction control valve :

Directional control valves are used to control the direction of flow. The design principle is a major factor with regard to service life actuating force switching times etc.

8. Piston and Cylinder

single acting pneumatic cylinder;

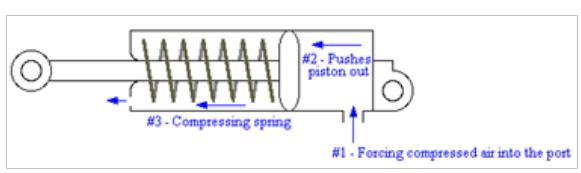


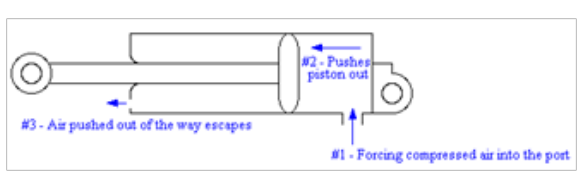
Pneumatic cylinders (sometimes known as air cylinders) are mechanical devices which produce force, often in combination with movement, and are powered by compressed gas (typically air).

To perform their function, pneumatic cylinders impart a force by converting the potential energy of compressed gas into kinetic energy. This is achieved by the compressed gas being able to expand, without external energy input, which itself occurs due to the pressure gradient established by the compressed gas being at a greater pressure than the atmospheric pressure. This air expansion forces a piston to move in the desired direction. The piston is a disc or cylinder, and the piston rod transfers the force it develops to the object to be moved.

When selecting a pneumatic cylinder, you must pay attention to:

- how far the piston extends when activated, known as "stroke"
- surface area of the piston face, known as "bore size"
- action type
- pressure rating, such as "50 PSI"
- type of connection to each port, such as "1/4" NPT"
- must be rated for compressed *air* use
- mounting method





Type

Although pneumatic cylinders will vary in appearance, size and function, they generally fall into one of the specific categories shown below. However there are also numerous other types of pneumatic cylinder available, many of which are designed to fulfill specific and specialised functions.

Single acting cylinders

Single acting cylinders (SAC) use the pressure imparted by compressed air to create a driving force in one direction (usually out), and a spring to return to the "home" position

Double acting cylinders

Double Acting Cylinders (DAC) use the force of air to move in

both extend and retract strokes. They have two ports to allow air in, one for outstroke and one for instroke.

Other types

Although SACs and DACs are the most common types of pneumatic cylinder, the following types are not particularly rare:

- Rotary air cylinders: actuators that use air to impart a rotary motion
- Rodless air cylinders: These have no piston rod. They are actuators that use a mechanical or magnetic coupling to impart force, typically to a table or other body that moves along the length of the cylinder body, but does not extend beyond it.

Sizes

Air cylinders are available in a variety of sizes and can typically range from a small 2.5 mm air cylinder, which might be used for picking up a small transistor or other electronic component, to 400 mm diameter air cylinders which would impart enough force to lift a car. Some pneumatic cylinders reach 1000 mm in diameter, and are used in place of hydraulic cylinders for special circumstances where leaking hydraulic oil could impose an extreme hazard.

Pressure, radius, area and force relationships

Although the diameter of the piston and the force exerted by a cylinder are related, they are not directly proportional to one another. Additionally, the typical mathematical relationship between the two assumes that the air supply does not become saturated. Due to the effective cross sectional area reduced by the area of the piston rod, the instroke force is less than the outstroke force when both are powered pneumatically and by same supply of compressed gas.

The relationship, between force on outstroke, pressure and radius, is as follows:

$$F = p(\pi r^2)$$

This is derived from the relationship, between force, pressure and effectivecross-sectional area, which is:

F = p A\

With the same symbolic notation of variables as above, but also A represents the effective cross sectional area.

On instroke, the same relationship between force exerted, pressure and effective cross sectional area applies as discussed above for outstroke. However, since the cross sectional area is less than the piston area the relationship between force, pressure and radius is different. The calculation isn't more complicated though, since the effective cross sectional area is merely that of the piston less that of the piston rod.

For instroke, therefore, the relationship between force exerted, pressure, radius of the piston, and radius of the piston rod, is as follows:

$$F = p(\pi r_1^2 - \pi r_2^2) = p\pi(r_1^2 - r_2^2)$$

Where:

F represents the force exerted

r_1 represents the radius of the piston

r2 represents the radius of the piston rod

π is pi, approximately equal to 3.14159.

VALVE CONNECTORS;



POLYURETHANE TUBE ; shortly say PUN tube;



Manual operations involving heavy lifting. Pushing or pulling motions can be firing for the operations and can induce a monotony which results in lowered production. Cylinders have been designed to carry out these movements with a pre – determined force and stroke and can be fitted to synchronize with operation cycles of many machines it is worth wile to examine the existing plan and methods of movement and to consider the numerous mechanical applications which the range of pneumatic cylinders make possible. Quality is to keynote of air cylinder. Engineer them into you production setup to get the last ounce of power, speed and efficiency to save time, space and money.

Piston is cylinder part which moves in a cylinder have corresponding hole on it. To make the strokes effective there is no gap between them or with a very tiny gap, part of the micron. The cylinder and its piston have a glazing surface where there is a contact between them for easy motion of piston and avoiding wear and tear of both. The outer side of the cylinder have mountings consists of plate and studs attached with it. But the of these mountings, the cylinder and piston assembly can fitted on any place of the piston have threads on it for fastening theother parts (or) accessories according the operating performed and the application required. We can fit holding devices, Clamping materials or other metal cutting and forming ports with which can be movable with the piston.

Pneumatics are used practically in every industry for a wide variety of manufacturing process, pneumatics equipments are used for multiple reasons. The best reason is that it is air powered ordinary air turns out to be very excellent as a fluid power components.

Solenoid Valve :

In order to automate the air flow in our system we have to provide an electrically controlled valves. Electrical devices can provide more effective control, less expensive interlocks having many additional safety features and simplified automatic sequencing when a machine must operate in a hazardous area, remote actuation is a desirable. The operator can provide satisfactory control though electrical devices from a remote point with in a safe area, uding a semi automatic system and these

electrical flow control devices are also in use in full automation by providing proper action signals.

Push and pull actuation can be priced b solenoids. These movements are used to open and close the pop pet type valves. These actuations are done according to the signals given to the solenoid coil when the decided by the program. The outlet of solenoiud coil when the decided by the program,. The outlet of solenoid valve is connected to a spray gun, which is going to spray the paint.

SOLENOID OPERATED VALVES:
Solenoid valves are electromechanical devices like relays and contractors. A solenoid valve is used to obtain mechanical movement in machinery by utilizing fluid or air pressure. The fluid or air pressure is applied to the cylinder piston through a valve operated by a cylindrical electrical coil. The electrical coil along with its frame and plunger is known as the solenoid and the assembly of solenoid and mechanical valve is known as solenoid valve. The solenoid valve is thus another important electromechanical device used in control of machines. Solenoid valves are of two types,

1. Single solenoid spring return operating valve,(5/2)
2. Double solenoid operating valve.

In fig 1 is shown a single solenoid spring return valve in its de-energized condition. The symbol for the solenoid and the return are also shown. The solenoid valve is shown connected to the cylinder to help readers understand

the solenoid valve action. In the de energized condition, the plunger and the valve spool position as shown in figure 1.

In this position of spool, port P is connected to port A and port B is connected to tank or exhaust (i.e. atmosphere) if air is used. Spring pressure (S) keeps the spool in this condition as long as the coil is de energized. Fluid pressure from port P through port A is applied to the left side of the cylinder piston. Thus the cylinder piston moves in the right direction. Now

when the solenoid coil is energized, plunger is attracted and it pushes the spool against spring pressure.

In this position of spool, port A gets connected to tank and port P gets connected to port B. Thus pressure is applied to the cylinder piston from right and moves the piston rod to the left. At the same time fluid in the other side is drained out to the tank. When the solenoid coil is again de energized, the spring (S) will move the spool to its original position as shown in figure 1. Thus, normally when the solenoid coil is de energized the piston rod remains extended.

PNEUMATIC FITTINGS:
There are no nuts to tighten the tube to the fittings as in the conventional type of metallic fittings. The tube is connected to the fitting by a simple push ensuring leak proof connection and can be released by pressing the cap and does not require any special tooling like spanner to connect (or) disconnect the tube from the fitting.

SPECIFICATION OF THE FITTING:

Body Material	- Plastic
Collect/Thread Nipple	- Brass
Seal	- Nitrate Rubber
Fluid Used	- Air
Max. Operating Pressure	- 7 Bar
Tolerance on OD of the tubes	- ± 1 mm
Min. Wall thickness of tubes	- 1 mm.

FLEXIBLE HOSES:
The Pneumatic hoses, which is used when pneumatic components such as actuators are subjected to movement. Hose is fabricated in layer of

Elastomer or synthetic rubber, which permits operation at high pressure. The standard outside diameter of tubing is 1/16 inch. If the hose is subjected to rubbing, it should be encased in a protective sleeve.

ADVANTAGES AND LIMITATIONS

ADVANTAGES:
- Machining time reduced
- Quick response
- Simple in construction easy to maintain and repair
- Cost of the unit is less when compared to other systems
- Comparatively the operation cost is less
- Continuous operation is possible without stopping

LIMITATIONS:
- Only sheet can be folded (For metals).
- Air leakage will reduce the efficiency of the system.
- Requires only compressed air

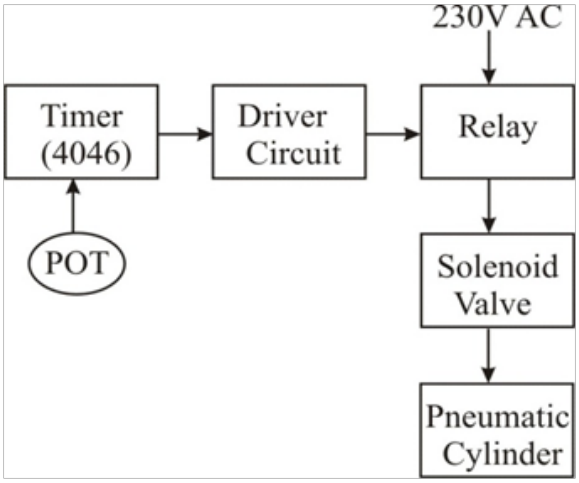
1) DISCHARGE OF WORKPIECE:
The arm fed has wide application in low cost automation. It can be used in automated assembly lines to pick-up the finished product from workstation and place them in the bins. It can also be used to pick-up the raw material and place them on the conveyor belts and vice versa.

2) JOB CLAMPING:
This unit can also be used in clamping operations in certain areas of mass productions where clamping and unclamping have to be done at high speeds. The application of this unit is limited to operations, which involves moderate clamping forces.

3) TRANSFER OF JOBS BETWEEN WORK STATIONS:
The gripping method used in a low cost automation to move the work piece from one workstation to another. The combination of an angular rotary motion is the principle behind this method. The gripper holds the work rigidly. The to and fro motion is achieved by means of the actuating cylinder.

4) TOOL CHANGING APPLICATION:
When the pneumatic arms are made smaller in size they can be used in automatic tool changer in CNC turning and drilling machines, by attaching suitable tool holding device to the rotary cylinder

BLOCK DIAGRAM



CONCLUSION

We make this project entirely different from other projects. Since concepts involved in our project is entirely different that a single unit is used to various purposes which is not developed by any of other team members.

By doing this project we gained the knowledge of working of pneumatic system and how automation can be effectively done with the help of pneumatic system.