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Pneumetic Bending Machine

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ABSTRACT:

Nowadays the world is focusing into automation. Each and every work of human is reduced by a machine, but few areas like construction the usage of machines for bending rods for stirrups which are used to withstand loads in beams and columns are not done by machine because the cost of machine is high and need skilled labours to operate it. So this project is aimed to do bending operation for stirrups using Pneumatic and named as pneumatic rod bending machine.

The main objective of our project is to implement the Pneumatic rod bending machine in the construction sites with less cost compared to the existing bending machines, and increasing the productivity of the stirrups.

The bending machine is one of the most important machine tool in sheet metal work shop. It is primarily designed for bending. The bend has been made with the help of punch which exerts large force on the work clamped on the die. The bending machine is designed in such a way that, it works automatically.

The automation strategy, when implemented is believed to result in reduced cycle time, costs and improved product quality. Other possible advantages are repeatability, increased productivity, reduced labor and integration of business systems. Automation is achieved with the help of Electro pneumatic system.

INTRODUCTION

Now a day in industries especially in automobile and other industries the automatic plate bending machines are widely used. Earlier the bending machines where operated manually. So the output of machine was very less. Because the movement of ram was done manually by rotating the screw. Now the technique of bending operation of the component is changed. Once the plate is loaded the operator should not only use once push button to start the machine. But he has operated two push buttons so that both the hands of the operator are engaged. This arrangement is made in order to avoid injuries to operators. The main aim of this project is to have the complete know how of pneumatic devices, sensors etc. by which the manually operated press or any machine can be converted into a semi or fully automatic unit.

In this project the bending machine is a semi-automatic bending machine, in which the loading and unloading of the component is done manually and the bending of the plate is done automatically

PNEUMATIC CYLINDER

The material needed for outcome 2 is very extensive so there are ten tutorials in this outcome . You will also be completing the requirements for outcome 1 which is integrated into it. The series of tutorials provides an extensive overview of fluid power for students at all levels seeking a good knowledge of fluid power equipment.

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On completion of this tutorial you should be able to do the following.

- Revise the basic units and quantities.
- Explain the working principles of a range of hydraulic and pneumatic cylinders.
- Describe the construction of cylinders.
- Describe the seals used in cylinders.
- Describe the ways that cylinders are mounted.
- Explain the symbols for cylinders.
- Explain the relationships between pressure, speed, force and flow rate.

On completion of this tutorial you should attempt worksheet 3 obtainable from the home page for fluid power.
As circuit construction requires an understanding of other components, you may not be able to complete all the exercises at this stage in which case you should come back to them later.

INTRODUCTION

Cylinders are linear actuators which convert fluid power into mechanical power. They are also known as JACKS or RAMS.

Hydraulic cylinders are used at high pressures and produce large forces and precise movement. For this reason they are constructed of strong materials such as steel and designed to withstand large forces.

Because gas is an expansive substance, it is dangerous to use pneumatic cylinders at high pressures so they are limited to about 10 bar pressure. Consequently they are constructed from lighter materials such as aluminium and brass. Because gas is a compressible substance, the motion of a pneumatic cylinder is hard to control precisely. The basic theory for hydraulic and pneumatic cylinders is otherwise the same.

THEORY FORCE

The fluid pushes against the face of the piston and produces a force. The force produced is given by the formula:

$$F = pA$$

p is the pressure in N/m2 and A is the area the pressure acts on in m2.

This assumes that the pressure on the other side of the piston is negligible. The diagram shows a double acting cylinder. In this case the pressure on the other side is usually atmospheric so if p is a gauge pressure we need not worry about the atmospheric pressure.

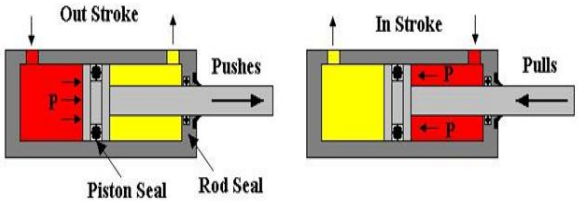

Figure 1

Let A be the full area of the piston and a be the cross sectional area of the rod. If the pressure is acting on the rod side, then the area on which the pressure acts is is (A - a).

F = pA on the full area of piston.
F = p(A-a) on the rod side.

This force acting on the load is often less because of friction between the seals and both the piston and piston rod.

SPEED

The speed of the piston and rod depends upon the flow rate of fluid. The volume per second entering the cylinder must be the change in volume per second inside. It follows then that:

Qm3/s = Area x distance moved per second
Qm3/s = A x velocity (full side)
Q m3/s = (A-a) x velocity (rod side)

Note in calculus form velocity is given by v = A dx/dt and this is useful in control applications.
In the case of air cylinders, it must be remembered that Q is the volume of compressed air and this changes

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with pressure so any variation in pressure will cause a variation in the velocity.

POWER

Mechanical power is defined as Force x velocity. This makes it easy to calculate the power of a cylinder. The fluid power supplied is more than the mechanical power output because of friction between the sliding parts.

$$P = F \text{ v Watts}$$

PNEUMATIC CONTROL VLAVES

Learning Objectives

Upon completion of this chapter, Student should be able to

- Define the function of a valve
- Classify the valves
- Identify the DCVs as per ISO designation
- Explain the various types of Directional control valves
- Explain the various method of valve actuation
- Describe the function of various Non return valves
- Understand the working of quick exhaust valves
- Differentiate pressure control valve and sequence valve

VALVES

Valve are defined as devices to control or regulate the commencement, termination and direction and also the pressure or rate of flow of a fluid under pressure which is delivered by a compressor or vacuum pump or is stored in a vessel.

Values of one sort or another, perform three main function in pneumatic installation

- They control the supply of air to power units, example cylinders
- They provide signal which govern the sequence of operation
- They act as interlock and safety devices

The type of valve used is of little importance in a pneumatic control for most part. What is important is the function that can be initiated with the valves, its mode of actuation and line connection size, the last named characteristics also determining the flow size of the valve. Valves used in pneumatics mainly have a control function that is when they act on some process, operation or quantity to be stopped. A control function requires control energy, it being desirable to achieve the greatest possible effect with the least effort. The form of control energy will be dictated by the valve's mode of actuation and may be manual, mechanical, electrical hydraulic or pneumatic.

Valve available for pneumatic control can be classified into four principal groups according to their function:

- Non return valves
- Flow control valves
- Pressure control valves

DIRECTION CONTROL VALVES

Pneumatic systems like hydraulic system also require control valves to direct and regulate the flow of fluid from the compressor to the various devices like air actuators and air motors. In order to control the movement of air actuators, compressed air has to be regulated, controlled and reversed with a predetermined sequence. Pressure and flow rates of the compressed air to be controlled to obtain the desired level of force and speed of air actuators.

The function of directional control valve is to control the direction of flow in the pneumatic circuit. DCVs are used to start, stop and regulate the direction of air flow and to help in the distribution of air in the required line.

Compressor:

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According to the design and principle of operation:-
1. Rotary screw compressor
2. Turbo compressor

Positive displacement:-

Positive-displacement compressors work by forcing air into a chamber whose volume is decreased to compress the air. Common types of positive displacement compressors are:-

- Piston-type air compressors use this principle by pumping air into an air chamber through the use of the constant motion of pistons. They use one-way valves to guide air into a cylinder chamber, where the air is compressed. Rotary screw compressors use positive-displacement compression by matching two helical screws that, when turned, guide air into a chamber, whose volume is decreased as the screws turn.
- Vane compressors use a slotted rotor with varied blade placement to guide air into a chamber and compress the volume. A type of compressor that delivers a fixed volume of air at high pressures.

Negative displacement:-

Negative-displacement air compressors include centrifugal compressors. These use centrifugal force generated by a spinning impeller to accelerate and then decelerate captured air, which pressurizes it.

Cooling:

Due to adiabatic heating, air compressors require some method of disposing of waste heat. Generally this is some form of air- or water-cooling, although some (particularly rotary type) compressors may be cooled by oil (that is then in turn air- or water-cooled)[3] and the atmospheric changes also considered during cooling of compressors.

Applications:-

- To supply high-pressure clean air to fill gas cylinders
- To supply moderate-pressure clean air to a submerged surface supplied diver
- To supply moderate-pressure clean air for driving some office and school building pneumatic HVAC control system valves
- To supply a large amount of moderate-pressure air to power pneumatic tools, such as jackhammers
- For filling tires
- To produce large volumes of moderate-pressure air for large-scale industrial processes (such as oxidation for petroleum coking or cement plant bag house purge systems).

Compressors - Saving Energy

Most air compressors either are reciprocating piston type, rotary vane or rotary screw. Centrifugal compressors are common in very large applications. There are two main types of air compressor's pumps: oil-lubed and oil-less. The oil-less system has more technical development, but is more expensive, louder and lasts for less time than oil-lubed pumps. The oil-less system also delivers air of better quality.

Compressor saving energy:-

- Reduce run time – turn off when not needed
- Lower system pressure to lowest possible level
- Repair leaks
- Recover waste heat
- Additional system volume (load/unload only)
- Reduce use of pneumatic tools

Air Supply Pipe:

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A pipe is a tubular section or hollow cylinder, usually but not necessarily of circular cross-section, used mainly to convey substances which can flow liquids and gases (fluids), slurries, powders, masses of small solids. It can also be used for structural applications; hollow pipe is far stiffer per unit weight than solid members.

In common usage the words pipe and tube are usually interchangeable, but in industry and engineering, the terms are uniquely defined. Depending on the applicable standard to which it is manufactured, pipe is generally specified by a nominal diameter with a constant outside diameter (OD) and a schedule that defines the thickness. Tube is most often specified by the OD and wall thickness,

Conclusion:-

The manually controlled press is converted into automatic machine by which maximum operating time will be saved. Thus the output will be more. In this project the human intervention is for loading and unloading the plate. It may be called as semiautomatic machine. This machine can be converted into a fully automatic machine where loading and unloading of the plate can be done automatically.

To conclude, this project is made keeping in mind that any manually operated machine can be converted to automatic machines by using pneumatic, electrical and electronic devices. For these purpose one should have the full know how of the devices which are being used. By doing so the existing old machines can be modified and made automatic by which the initial cost, to procure new automatic machines may be minimized. Thus there is a lot of scope in this area (automation).

Further in this project the wiring is very much complicated, if any troubleshoot occurs then the fault cannot be easily found, for this the interface with the PLC can be used, by which the wiring is minimized and the fault can be easily detected without waste of time.

Hence there is still wide scope in the automation are where lots of improvement can be made with the help of the latest technology

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