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Fabrication of Pneumatic Bench Vice

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A B S T R A C T

The purpose of this project is to develop a pneumatically operated bench vice model. Using air pressure to create mechanical motion in the vice's spindle reduces human effort in a safe and effective manner. A double actuating cylinder is used to provide mechanical motion in the spindle, which is controlled by a 5/2 pilot valve and two 3/2 push buttons through air hoses.

Keywords:Pressure, Bench Vice, Compressor

1.Introduction

It's a device that holds work components for various machining operations like fitting and finishing, and it's attached to the work table via bolts and nuts that pass through holes in the vice base.
FIXED JAW: It is usually cast integral with vice body or base.
MOVABLE JAW: It slides on the ways of the casting & is operated with a screw or spindle.
SCREW: It gives movable jaw the forward or backward movement.
CASTING: It constitutes the base of the vice & has ways for the movable bar.

Pneumatics is a branch of engineering that deals with the mechanical properties of gases, such as pressure and density, and uses compressed gas as a source of energy to solve problems. Air is the most often utilized compressed gas, and its use has become synonymous with pneumatics. The straightforward conversion of pressure into force and translational displacement using a piston in a circular bore is the most important attribute of medium air today. A pneumatic vice is a mechanical screw apparatus for holding or clamping a workpiece so that instruments like saws, planes, drills, mills, screwdrivers, and sandpaper can be used to operate on it. Vices typically feature one fixed jaw and a parallel jaw that moves towards or away from the fixed jaw through a screw. A vice is used to drill wood, metal, and other materials. It provides all the stability you need to make perfect cuts by tightly holding your product. A pneumatic system is made up of a collection of pneumatic components that are connected so that a signal (compressed air) can be sent through the system to cause something to happen at the output.

2.Elements Of Pneumatic Bench Vice

I)Supply Elements:
these elements are the sources of power that drive the system which is the compressors.

Ii)Input Elements:

These components are used to deliver signals to the final control elements and are available in two types: components that are triggered by the user, such as push buttons, and sensors that determine the condition of the power elements, such as limit switches and proximity sensors.

Iii)Processing Elements:
Before transmitting the signal to the final control components, such as non-return valves, directional control valves, and presser control valves, these elements may execute operations on the input signal.

Iv)Final Control Elements:
to control the motion of actuators such as directional control valves.

V)Power Elements (Actuators):
these are the outputs of the pneumatic system which use the stored potential energy to perform a certain task such as pneumatic cylinders and motors.

Main Component Of Pneumatic Vice
1. Compressor
2. Direction Control Valve
3. Flow Control Valve
4. Double Acting Cylinder

1)Compressor
Air can be compressed to the desired pressures using a compressor. It can transform mechanical energy from motors and engines into compressed air potential energy. A single central compressor can supply compressed air to several pneumatic components, which is delivered via pipes from the cylinder to the pneumatic components. There are two types of compressors: reciprocator and rotary.
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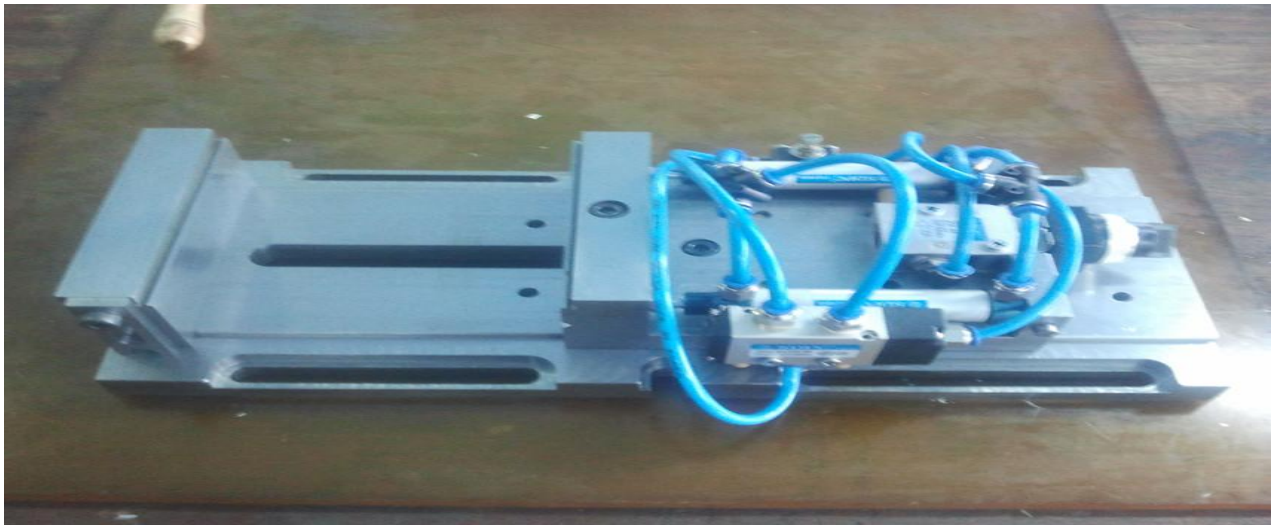
2)Direction Control Valve
By opening, closing, and altering their internal connections, directional control valves ensure the passage of air between airports. The number of ports, the number of switching positions, the typical position of the valve, and the way of operation are used to classify them.

3)Flow Control Valve
A flow control valve is formed by a non-return valve and a variable throttle.

4)Double Action Cylinder
Air pressure is alternatively supplied to the relative surface of the piston in a double-acting cylinder, creating a propelling and retraction force. The thrust produced during retraction is rather moderate due to the narrow effective area of the piston. Steel is commonly used for the perfect tubes of double-acting cylinders.



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3.Advantages of Pneumatic system

Pneumatic control systems are widely employed in contemporary culture, particularly in the industrial sector to drive automatic machinery. There are numerous advantages to pneumatic systems.

1) High efficiency: Many industries have compressed air supplies and moveable compressors installed on their production lines. Compressed air can be made from an infinite supply of air in our environment. Furthermore, compressed air has no distance limitations because it may readily be transferred through pipes. Compressed air can be released straight into the atmosphere without being processed after usage.

2) Longevity and dependability: Pneumatic components are exceedingly durable and difficult to break. Pneumatic components are more durable and

reliable than electromotive components.

3) Simple design: Pneumatic components have relatively simple designs. As a result, they're better suited to simple automatic control systems.

4) High adaptability to severe environments: Compressed air is less impacted by high temperatures, dust, corrosion, and other factors than other system components.

5)Security: Pneumatic systems are safer than electromotive systems because they may operate in flammable environments without igniting or exploding. Aside from that, overloading a pneumatic system will simply cause it to slide or stop working. Pneumatic components, unlike electromotive components, do not burn or overheat when overused.

6) Simple speed and pressure selection: The rectilinear and oscillating movement rates of pneumatic systems are simple to change and have few constraints. A pressure regulator can simply control the pressure and volume of air.

7) Environmentally friendly: Pneumatic systems do not emit pollutants during operation. The air that is released is also treated differently. As a result, pneumatic systems can function in areas where a high level of cleanliness is required. Integrated circuit production lines are one example.

8) Economical: Because pneumatic components are inexpensive, pneumatic systems are inexpensive. Furthermore, because pneumatic systems are extremely durable, repair costs are much lower than for other systems.

4.Advantages of Pneumatic Vice

1) Simple to use.

2) Design that is stable and stiff.

3) Clamping force is really high.

4) High repeatability and precision reduce production costs.

5) The design is compact and easy to use, requiring little upkeep.

6) Can be installed vertically or horizontally.

5.Disadvantages of Pneumatic system

Although pneumatic systems possess a lot of advantages, they are also subject to many limitations.

1) Low accuracy: Because pneumatic systems are driven by compressed air, their function is limited by the volume of compressed air available. Because the amount of air changes when compressed or heated, the air supply to the system may not be correct, lowering the system's overall accuracy.

2) Low loading: Because pneumatic components' cylinders are small, a pneumatic system cannot drive very heavy weights.

3) Prior to use, compressed air must be treated to ensure that it is free of water vapour and dust. Otherwise, friction could cause the pneumatic components' moving parts to wear out quickly.

4) Unequal movement speed: Because air is easily compressed, the pistons' moving speeds are uneven.

5) Noise: When compressed air is released from pneumatic components, noise is produced.

6.Safety measures for Pneumatic control system

1) If compressed air enters the body through channels such as the oral cavity or ears, it can cause catastrophic injury.

2) Never squirt compressed air on someone.

3) Compressed air can flow through human skin at high temperatures.

4) Particles and oil droplets in the compressed air emitted from the exhaust can cause eye harm.

5) Even while the pressure of pressurized air in pipes and reservoirs is generally low, powerful explosions can nonetheless occur if the container loses its wholeness.

6) Before turning on a compressed air supply unit, make a thorough inspection of the entire circuit for any loose parts, abnormal pressure, or damaged pipes.

7) Due to the tremendous pressure inside a leaky pipe, it may shake violently. To avoid accidents, a comprehensive inspection of the complete circuit is essential each time the system pressure is increased.

8) Because the power produced by pneumatic cylinders is relatively large, and the action is usually very fast, if you are struck by one, you may sustain significant damage.

9) Air flow should be controlled easily and quickly with switches mounted on the compressed air supply device.

7.Conclusion

As a result, the project provides a framework for quickly repairing and working on the workpice. The pneumatic vice has a very strong clamping force as well as excellent accuracy and reproducibility. The pneumatic system has a high output rate. Noise can be produced when compressed air is discharged from pneumatic components. Pneumatic systems do not emit any pollutants when they are in use. As a result, the pneumatic vice is simple to operate.

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