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DESIGN AND FABRICATION OF PNEUMATIC ARM

Naveen Kumar. D[1#], Pravin Kanth P*[2] Sakthi Kumar R*[3] Vanoli P*[4]
[#1]*Student, Mechanical, Kings Engineering College, Chennai, India*
[*2]*Student, Mechanical, Kings Engineering College, Chennai, India*
[*3]*Student, Mechanical, Kings Engineering College, Chennai, India*
[*4]*Student, Mechanical, Kings Engineering College, Chennai, India*

ABSTRACT- Pneumatic arm is a device is used to pick and place the materials or object as we required. By considering the mechanical arm's performance objectives, the design starts with modelling the integration of all the individual links constituting the manipulator. During the design process, modifications are made based on integrated information of kinematics, dynamics and structural analysis of the desired robot configuration as a whole. An optimum assembly design is then achieved with workable sub designs of the manipulator components. As a result, the proposed approach for manipulator design yields substantially less number of iterations, automatic propagation of design changes and great saving of design efforts.The main aim of this project is to create a device at low cost and low space occupied. As in many small scale industries they use large number of labors are used to do the work. We have involved in a chain process to construct a device with good strength to pick and place the materials.

I INTRODUCTION

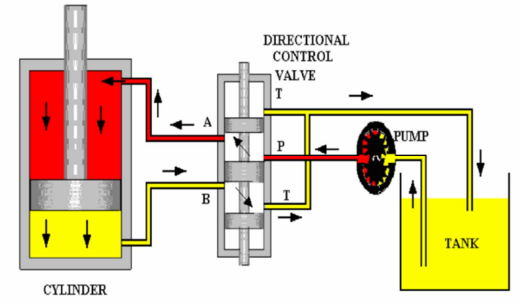
This model is an economical and practical instrument designed to pick and place the materials. It can meet the demands of specimen preparing from customers very well. Pneumatic arm is a perfect device to pick and place the materials. It works with the help of pneumatics. A 5/2 direction control valve is used for changing the direction of air. Double acing cylinder is used for upward and downward motion of an arm. It also used to pick and place the objects. A polyurethane tube is also used to provide easy movement of air.

A flow control valve is used to control the flow of air from the compressor. The minimum pressure is to be 4 bar from the compressor. Compressor is the main requirement in this process. We had involved in a chain process to construct this machine in an accurate manner. Mild steel is used to construct the whole machine in order to bear all stresses and weight that comes out from the machine. A solenoid switch is used to change the direction of air in a required way. The pneumatic machine provides greater loading capacity for a carrier than manual pressing. A pneumatic logic system is generally used to control the industrial robots. Since electronic circuits and not used thus precise and accurate pneumatic circuits are designed and implemented.

1.1 Introduction To Pneumatic System

Pneumatics is a branch of technology that deals with the study and application of pressurized gas to effect mechanical motion. Pneumatic system is extensively used in industry, where factories are commonly pumped 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 is often able to provide motive power in a cheaper, safer, more flexible, and more reliable way than a large number of electric motors and actuators. Pneumatics also find applications in dentistry, construction, mining and other area

Fig 1: Pneumatic System



Sequential circuits are designed so that each cylinder is actuated at proper sequence and are also kept active for the desired period of time. This the only challenge in a low cost robotic arm is designing of the pneumatic circuit.

1.2 gases used in pneumatic system

Pneumatic system in fixed installations such as factories use compressed air because a sustainable supply can be made by compressing atmospheric air. The air usually has moisture

removed and a small quantity of oil added at the compressor, to avoid corrosion of mechanical components and to lubricate them.

Factory-plumped, pneumatic-power users need not worry about poisonous leakages as the gas is commonly just air. Smaller or stand-alone systems can use other compressed gases which are most hazard such as nitrogen-often referred to as OFN (oxygen-free nitrogen), when supplied in cylinders.

Any compressed gas other than air is an asphyxiation hazard – including nitrogen, which makes up 77% of air. Compressed oxygen (approx. 23% of air) would not asphyxiate, but it would be an extreme fire hazard, so it is never used in pneumatically powered devices.

Portable pneumatic tools and small vehicles such as Robot wars machines and other hobbyist applications are often powered by compressed carbon-dioxide because containers designed to hold it such as soda stream canisters and fire extinguishers are readily available, and the phase change between liquid and gas makes it possible to obtain a larger volume of compressed gas from a lighter container than compressed air would allow. Carbon-dioxide is dangerous and also be a freezing hazard when vented inappropriately.

1.3 why we used compressed air pneumatic system?

We used pneumatic system, as it has some advantages over the hydraulic system. There is no need for fluid replenishment. Light tubing/piping is sufficient. There is no fire hazard. But in our pneumatic system, we have used air as a working fluid, because air has the some advantages over the other gases. Properties of air are very suitable for pneumatic system.

1.4 Properties of air

Air is a mixture of 78% nitrogen, 21% oxygen and 1% other inert gases with moisture by volume. Air exerts pressure at sea level of about 1.013 bar (14.7 psi) called atmospheric pressure. It is equivalent to 760 mm of Hg or 10.3 m of water pressure as measured by U-tube manometer. Other physical properties of air are:

- ✓ Molecular mass, M = 28.96 kg/kg mol.
- ✓ Boiling point at 1 bar = -191º C to -194º C.
- ✓ Freezing point at 1 bar = -212º C to -216 ºC.
- ✓ Characteristic gas constant, R = 287 Nm/kg
- ✓

II MATERIAL SELECTION

2.1 Material For Frame–Mild Steel

Mild Steel is one of the most common of all metals and one of the least expensive steels used. I is to be found in almost every product created from metal. It is weld able, very durable, it is relatively hard and is easily annealed. Having less than 2% carbon it will magnetize well and being relatively inexpensive, can be used in most projects requiring a lot of steel. However when it comes to load bearing, its structural strength is not usually sufficient to be used in structural beams and girders.

2.2 material for base plate-mild steel

We also use the same material for the base plate and the material for the base plate is mild steel. Mild steel can also be described as steel which is not stainless steel. Mild steel differs from stainless steel in its chromium content. Stainless steel contains a lot more chromium than ordinary carbon or mild steel.

2.3 Frames

- ✓ **Material**
  Oil hardened non shrinkage Steel
- ✓ **Method of manufacturing**
  Shaping, Grinding, Drilling, Wire-cut machining
- ✓ **Purpose**
  To hold the pneumatic cylinder and to support the assembly

2.4 Base Plate

- ✓ **Material**
  Oil hardened non Shrinkage Steel
- ✓ **Method of Manufacturing**
  Shaping, Grinding, Drilling, Wire-cut Machining
- ✓ **Purpose**
  To hold the full arrangement and to support the assembly

III FABRICATION

3.1 Construction

In this project we have designed a Pneumatic Arm to pick and place the objects. We have used double acting cylinders to perform the upward and downward motion of the piston. A 5/2 direction control valve is fixed on the stand. It is used to change the direction of the air. Double acting cylinders are attached to the stand to provide motion to the piston.

A flow control valve is used to control the flow of air from the compressor. The minimum pressure is to be 4 bar from the compressor. Compressor is the main requirement in this process.

The C- clamps are used to hold the double acting cylinder in the stand. The minimum pressure is 4 bar. Polyurethane tube is used to provide free movement of air.

Mild steel is used to construct this whole machine in order to bear all stresses and weight that comes out from the machine. By doing all this arrangements we can get high accuracy and good surface finish and we save time in mass production.

IV WORKING

The working principle of a pneumatic arm is based on the conversion of pneumatic energy into mechanical energy. When the machine is switched on a minimum pressure of 4 bar is come to the compressor. It is a perfect device to pick and place an object in the required shape. It works by pneumatic manner. A 5/2 valve is used to change the direction of the air. A gripper is used to pick and place the object if we want to take.

The pneumatic cylinder is fixed with the help of frames and clamps. One pneumatic cylinder is placed vertical and other is placed horizontal. The horizontal cylinder is used to move the object to up and down and the vertical cylinder is used to operate the gripper to pick and place the object.

Mild steel is used to construct the whole arrangement in order to bear all stresses and weight that comes out from the machine. A solenoid valve is used to change the direction of air in the regular way. The pneumatic machine provides a greater loading capacity for a carrier than manual processing.

V CONCLUSION

While concluding this part, we fill quite contended in having completed the project assignment well on time. We had enormous practical experience on the manufacturing schedules of the working project model. We are therefore, happy to state that the inculcation of mechanical aptitude proved to be a very useful purpose. We are as such overwhelmingly elated in the arriving at the targeted mission.

Undoubtedly the joint venture has had all the merits of interest and zeal shown by all of us the credit goes to the healthy co-ordination of our batch colleague in bringing out a resourceful fulfillment of our assignment described by the university.

Although the design criterion imposed challenging problems which however were welcome by us due to availability of good reference books. The selection of choice of raw materials helped us in machining of the various components to very close tolerances and thereby minimizing the level of wear and tear.

In this report, we developed a branch and bound approach which is coupled with quick, effective bounds to optimize the movement of a robot which serves the material handling requirement within a manufacturing cell.

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