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Pneumatic Operated Material Handling Equipment

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ABSTRACT

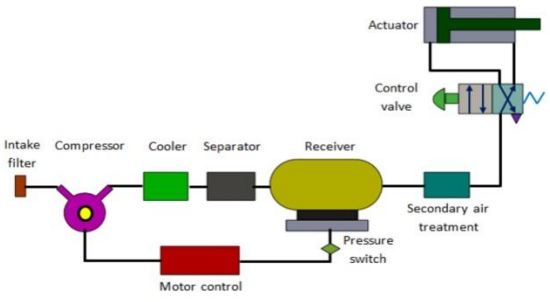
In industry, material handling plays an important role. For this one can go for belt conveyors, screw conveyors, trucks, trolley but these have some disadvantages like high initial as well as maintenance cost. Also labour cost and labour efforts required are more.Hence to reduce man efforts as well as the initial cost one can go for pneumatic operated material handling equipment in which working medium is compressed air, if available the system becomes economic.The project 'Pneumatic Operated Material Handling Equipment' name itself indicates that it is basically designed for material handling. This project is mainly used for ensuring that a material to be transferred from one place to another place where we want to store it.The equipment mainly consists of pneumatic sequencing circuit A+B+A-B- or A+B+B-A- (by using one way trip valve), a trolley, one pot, two supports, eye end.

Keywords:Material Handling,Pneumatics, Simulation

INTRODUCTION

Material handling is necessary in a day to day operation to increase the productivity in industries.
The existing systems are manual and mechanical systems but these have disadvantages like time consuming, high labour cost, more space is required and complicated operation and high initial cost also.
A large part of the indirect labour employed in manufacturing plant the in the handling of materials. It has been estimated that average material. handling cost is roughly 20 to 25% of the total production cost. It thus becomes clear that the cost of production of an item can be lowered considerably by making a saving in the material handling cost.

To overcome these points one can go for 'Pneumatic Control System'. Particularly known as Low Cost Automation' which is the introduction of pneumatic control. To reduce idle time and labour effort and increases the productivity.
The technology of pneumatics deals with the study of the behaviors and application of compressed air. Due to ease of availability and non-hazardous nature of air pneumatics is found increasingly in industrial automation. It is the best solution to low cost automation in industries. As the name implies, pneumatic system typically use air as the fluid medium because air is safe, low cost and readily available fluid.



OBJECTIVES

In the modern era of competition, this has acquired greater importance due to growing need for reducing the manufacturing cost. The importance of material handling function is greater in those industries where the ratio of handling cost to the processing cost is

large. Today material handling is rightly considered as one of the most potentially lucrative areas for reduction of costs. A properly designed and integrated material handling system provides tremendous cost saving opportunities and customer services improvement potential. The foremost importance of materials handling is that it helps productivity and thereby increases profitability of an industry. In many instances it is seen that competing industries are using same or similar production equipment, and one who uses improved materials handling system stays ahead of their competitors. A welldesigned materials handling system attempts to achieve the following:

• Improve efficiency of a production system by ensuring the right quantity of materials delivered at the right place at the right time most economically.
• Cut down indirect labour cost.
• Maximise space utilization by proper storage of materials and thereby reduce storage and handling cost.
• Reduce damage of materials during storage and movement.
• Reduce overall cost by improving materials handling.
• Improve customer services by supplying materials in a manner convenient for handlings.

LITERATURE REVIEW

Anthony Esposito [1] This book (Fluid Power with Applications) presents the details of pneumatics such as properties of air, compressors, air control valves, pneumatic actuators etc. and many more. It describes the preparation of compressed air with compressors. Different parts of the compressors along with their functions have also been discussed.The book also describes the pneumatic circuit design considerations and their applications. The selected portions of the book were studied and understood. The basic ideas for the system were developed after studying the book. The review of the book formed the basis for the pneumatic based materials handling system.

EurIng Ian C. Thrner [2] This book (Engineering Applications of Pneumatics and Hydraulics) presents the detail concepts of control valves, their types and principles of operation; pneumatic actuators, pneumatic circuits and arrangement of components. Theimportant portions of the book were reviewed. The understanding of the concepts of pneumatics was developed. The review of the book also helped in selecting suitable control valves such as directional control valves required in the pneumatic system. It also provided the information about the pneumatic circuits and arrangement of the components

S. Premkumar, K. Surya Varman, R. Balamurugan [4]This paper mainly focuses on the design and implementation of multi handling pick and place robotic arm. Robotic arm consists of revolute joints that allowed angular movement between adjacent joint. Three double acting cylinders were used to actuate the arm of the robot. Robot manipulators are designed to execute required movements. By using this collaborated mechanism the success rate of pick and place robots are increased. The rack and pinion is welded with piston of the double cylinder, by actuating the hand lever valve the vertical arm will attain its 360 degrees rotary moment. While the angular moment of the horizontal arm is actuated by the double acting cylinder and 3/2 hand lever valve. The material handling equipments such as gripper and vacuum suction cup are mounted over the arm. The to and fro movement of the gripper is actuated by a separate double acting cylinder and gripper is operated by using BO motor. The robots contain two vacuum suction cups which generate vacuum with the help of vacuum generator. Compressor continuously delivers the air to the cylinder with help of the cylinders all the parts of the robot were operated. By using gripper and vacuum suction cup both the flat and irregular shaped materials were handled.

METHODOLOGY

The methodogy behind the current project work involves the preparation of the project plan, selection of pneumatics, selection of components with appropriate materials, design calculation and assembly of the equipment.

Preparation of Project Plan

In this stage we started preparing the machine design and the concept. The way our Arm would look was decided and studied thoroughly. The first conceptual plan is as shown and various changes were made to improve the performance and to make cost effective.

Design of Components

Horizontal, vertical, rotary cylinders & arm lifting cylinder are of same design and selected from the pneumatic product catalogue. Cylinders are of double acting type. According to the applications the forward and return stroke of the piston has to be controlled with some time interval. So, double acting cylinders are preferred. This time interval cannot be achieved by single acting cylinders.

WORKING PRINCIPLE

Pneumatic conveying involves moving of bulk material in a stream of various carrier gases in closed tubes (pipelines). Air mover supplies the specified volumetric flow rate of the free air maintaining the appropriate pressure in the conveying system. Air movers available for the pneumatic conveying system applications ranges from the fans and blowers producing high volumetric flow rates at relatively low flow rates and vice versa . A relatively high velocity is required and controlled by blower. Hence keeping the power requirement same the velocity of conveying medium i.e. air can be increased by implementing venturi feeder.

Venturi feeder consists of a short length of pipe shaped like a vena contracta, or the portion with the least cross-sectional area, which fits into a normal pipe-line. The hindrance caused to the flow of liquid at the throat of the venturi produces a local Pressure drop in the region that is proportional to the rate of discharge. The throat diameter is typically between 1/3 and ¾ of the inlet pipe diameter. Filtration unit is a gas solid separation device performs two functions. Firstly, it recovers conveyed material as much as possible for the next stage of handling or treatment process. Secondly, it minimizes the pollution of the working environment.

ADVANTAGES

The followings are some major advantages pneumatic materials handling equipment:

• The pneumatic arm is more efficient in the technical field

• Quick response is achieved

• Easy to maintain and repair

• Cost of the unit is less when compared to other robotics

• No fire hazard problem due to over loading

• Comparatively the operation cost is less

• The operation of arm is faster because the medium used to operate is air

• Continuous operation is possible without stopping

APPLICATIONS

Discharge of work piece

The arm feed has a wide application in low cost automation industries. It can be used in automated assembly lines to pick up the finished product from workstation and place them in bins. it can also be used to pick raw material and place them on the conveyor belts.

Work clamping

This unit can also be used in clamping. Operation in certain areas of mass production where clamping and an clamping have to be done at high speeds. The application of these units is limited to operations which involved moderate clamping forces.

Tool Changing Application

When the pneumatic arms are made smaller in size they can be used in automatic tool changes in CNC turning and drilling machines, by attaching tool holding device to the rotary cylinder.

RESULTS

The Pneumatic Operated MaterialHandlingEquipment was developed. The equipment
was tested to ensure satisfactory results as expected. The experimentation on theequipment provided the output result of the equipment. The working of the equipment was found to be satisfactory. However, the capacity of materials handling of theequipment was less compared to the designed load handling capacity.

CONCLUSION

1. By using Pneumatic Operated Material Handling Equipment, it ispossible to reduce the effort on the labour.
2. By using Pneumatic Operated Material Handling Equipment, it is possible to reduce the idle time. Hence possible to increase the overall efficiency fo the plant.

3. By using Pneumatic Operated Material Handling Equipment, it is possible to keep the clean space which is one more aspectand and point for getting ISO-9000.
4. The labour is operating the system gets more interest, while operating it. Hence it is possible to bost up the overall performance of the plant.
5. It possible to control the velocity of the piston hence gives good results.
6. As the compressed air is available hence indirectly it gives the saving of the power.
7. Though even the initial cost is more it is possible to compensate it as the extra earning in the form of saving of idle time and byminimizing the efforts of the labour.

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