Design, Analysis and Fabrication of Pneumatic Belt Conveyor System

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Abstract-*Pneumatic conveying system is a conventional material handling system like belt conveyor. The main advantage of pneumatic belt conveying system is that material is transferred in close loop, thereby preventing the environmental effect on the material because air is used as working medium. Belt conveyor system is the transportation of material from one location to another location. Belt conveyor has high load carrying capacity over longer distance (upto 3-4 km). Belt conveyor system is also used various industries such as the material transport in foundry shop like supply and distribution of molding sand, molds and removal of waste, coal and mining industry, sugar industry, agricultural industry, bagasse industry, fuel industry etc. Belt conveyor system can be employed for easy handling of materials beyond human capacity in terms of weight and height. In design the belt conveyor system different parameter are calculated such as length of belt, capacity and speed, pulley diameter, tension in belt, power required to drive the driver and driven pulley, location and arrangement of pulley, pressure required to move piston and control mode and then analyse the design by using ANSYS16 software. The configuration of the pneumatic belt conveyor system changes as well as variable involved also changes, according to the applications.*

Keywords-Conveyor, Pneumatic Conveying System, Pressure difference, Velocity.

I. INTRODUCTION

In modern world many techniques have been adopted in the field of material handling, as “Design, Analysis and Fabrication of Pneumatic Belt Conveying System”. The operations of this unit are controlled by pneumatic methods. Pneumatic methods are attractive for low cost mechanism particularly for sequential (or) repetitive operations. To increase the productivity and to overcome skilled labour shortage, most of the manufacturing industries are going for automation. The main aim for us to select the project work is to acquire practical knowledge in the field of automation using Pneumatic system.

We selected “Design, Analysis and Fabrication of Pneumatic Belt Conveying System” as our project work and we used principles of converting linear reciprocating motion into rotary motion in developing this project work, the material handling mechanism is achieved by reciprocating the double acting cylinder which is controlled by solenoid operated 5/2 way DC valve which is actuated by ON/OFF relay control system. Here the linear motion of the piston rod is converted to rotary motion of the belt conveyor through the chain and sprocket wheel mechanism.

1.1 SYNOPSIS

To increase the productivity and to overcome skilled labour shortage, most of the manufacturing industries are going for automation. The main aim for us to select the project work is to acquire practical knowledge in the field of automation using Pneumatic system.

We selected “fabrication of pneumatic conveying system” as our project work and we used principles of converting linear reciprocating motion into rotary motion in developing this project work, the material handling mechanism is achieved by reciprocating the double acting cylinder which is controlled by solenoid operated 5/2 way DC valve which is actuated by ON/OFF relay control system. Here the linear motion of the piston rod is converted to rotary motion of the belt conveyor through the chain and sprocket wheel Mechanism.

Moreover the same set up can be modified to automatic vibrating machine by simply removing the rotary mechanism and attaching a box or container to the piston end rod.

II. LITERATURE REVIEW

N. Bodkhe, In This paper we studied that The Pneumatic Conveying System is a conventional material handling system like belt conveyor or chain conveyor[1]. The main advantage of pneumatic conveying system is that material is transferred in close loop, thereby preventing the environmental effect on the material and vice versa. In these topic different parameters like air velocity, pressure, particle size and shape, distance to be conveyed, which govern the design of the system, are described. The research work carried out on the pneumatic conveying system in the last decade

considering these parameters are also presented.

S. Sahgal, In this paper he said that The Pneumatic conveying systems are generally sinuous [2]. A very wide variety of materials can be handled and they are fully enclosed by the system and pipeline. This means that potentially hazardous materials can be conveyed quite safely. Based on the quantity of air used and pressure of the system, pneumatic conveying systemis divided into two type's namely dense phase pneumatic conveying system and dilutes phase pneumatic conveying system.

In dense phase conveying two modes of flow are recognized. One is moving bed flow, in which the material is conveyed in mounds on the bottom of the pipeline, or as a pustule moving bed, when viewed through a sight glass in a horizontal pipeline. Scott D. Noble, In this paper we studied that The Pneumatic conveying is an important and widely used method of handling agricultural materials [3]. Specifically, air seeders employ dilute-phase pneumatic conveying for transporting seed and granular materials from the air cart to the seeding implement (air hoe-drill or disc-drill). This method of seeding is popular for planting wheat and other small and medium grains in large field sin western Canada, the U.S. Midwest, Australia, Ukraine and Russia.

III. COMPONENTS OF PNEUMATIC MATERIAL HANDLING SYSTEM

Table 1
List of structural and instrumental panels

S. No.	Items	Requirements
1	M.S. Square channel Frame Stand	1
2	ON/OFF relay control	1
3	24VDC power supply	1
4	Chain with sprocket assembly	1
5	Double acting cylinder	1
6	Flow control valve	1
7	Pulley	2
8	Valve Connectors	5
9	Nylon Belt	1

3.1 M.S. Square channel Frame Stand

This M.S. square angle frame Base stand is fabricated to a size of 450 mm x 900 mm x 500 mm (L*B*H) and is made with M.S. square channel material of 18mm X 18mm size having 3mm thickness. All the above components are kept inside the stand. Four wheels are fitted at the bottom for its movement.

Fig.1. M.S. Square channel Frame

3.2 ON/OFF relay control

The 5/2 way solenoid operated directional control valve is controlled by the ON/OFF relay control system and hence the

Cylinder piston rod reciprocated continuously.

SPECPCATION OF RELAY:

a) Nature of supply: dc
b) Coil voltage: 12v
c) No of NO and NC contacts: 1
d) No of poles: single pole double throw
e) Shape of contact point: flat
f) Contact point material: silver or silver alloy
g) Type of relay: electro dynamic

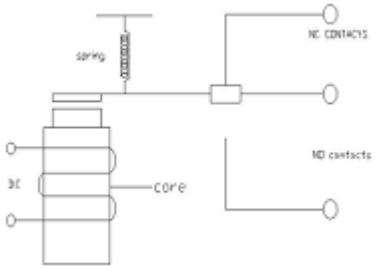

Fig.2. On off relay control

3.3 24VDC power supply

This power supply supplies the 24VDC power to the solenoid coil in the 5/2 way solenoid operated directional control valve.

3.4 Chain with sprocket assembly

The piston end rod is connected to the wooden block on which a chain of small length is fixed in straight horizontal position. The chain and the cylinder assembly set up on a lengthy wooden block and its height can be adjusted to fit the ratchet wheel with the help of four vertical bolt &screws.

Ratched wheel is attached to the driving cycle wheel from which the motion transmitted to the driven wheel through the nylon belt.

3.5 Double acting cylinder

In this unit, one air cylinder is used to push the chain in order to rotate the sprocket wheel. One cylinder is mounted at the bottom of the wheel. The size of the cylinder is 20 dia. X 100 MM stroke. The cylinder port A, B is connected to the directional control valve of the A, B port through the flow control valve.

Fig 3 .pneumatic cylinder

3.6 Flow control valve

This flow control valve is used to control the speed of the piston movement in the cylinder. Two flow control valves are mounted on each port of A and B of the cylinder jack unit.

Fig. 4. Flow control valve

IV. WORKING PRINCIPLE

Before starting the operation of material handling system set the working pressure to 5 bar from the compressor outlet.. Connect the 230 AC power supply to the female electrical plug in order to supply the electrical power to the relay control system and hence the solenoid valve direct the air supply to the double acting cylinder. The piston in the air cylinder reciprocates to and fro.

When the solenoid coil is ON ,the valve changed the direction of air to the double acting cylinder. Thus the valve reciprocates to and fro continuously till power is cut off .This reciprocate motion is converted to rotary motion with help of ratchet wheel mechanism and the nylon belt moves over the driving and driven pulley.

4.1 MECHANICAL ASSEMBLY DIAGRAM

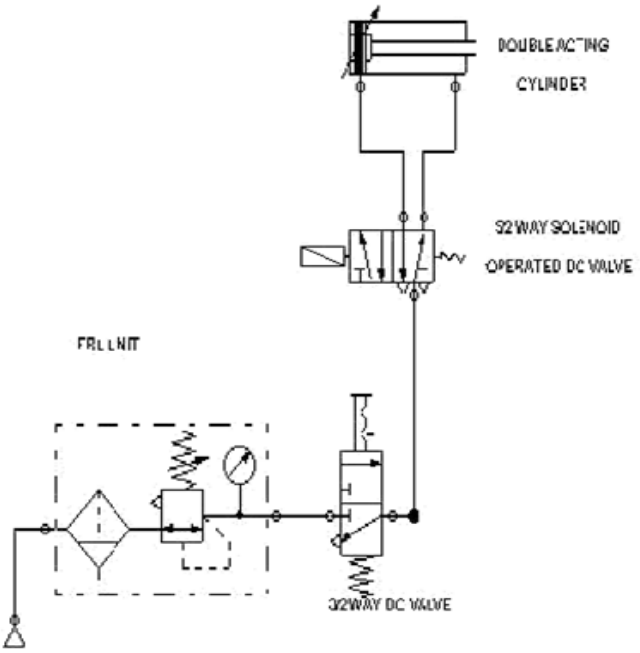

Fig.5. Working principle

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

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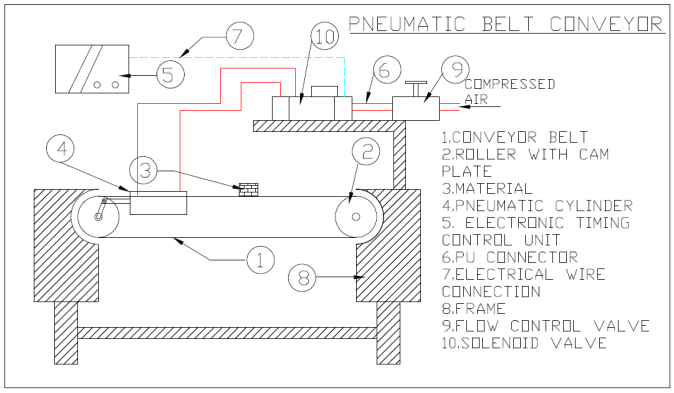

V. CONCLUSION

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. It is concluded that any automation system can be done with the help of electro pneumatic system. In this project, we have described and experimented a conveyor based on an aerodynamic traction principle. A model of the system has been established for different kinds of objects and the parameters have been identified. By doing this project work, we understood the working principle and uses of various valves, switches, relays etc.

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