

DESIGN AND FABRICATION OF A PNEUMATIC TIME DELAY CIRCUIT

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Abstract: The project deals the predetermined time delay circuit used in pneumatic system. The time delay to be required to actuate the pilot operated direction control valve, pneumatic actuates a material handling platform. At the end of the extension stroke, the platform has to wait for a predetermined time for material removal and then it has to return back. For such application, a time delay valve is an ideal solution and the project can be achieved.

Keywords: Air Cleaners, Compressors, Fluid flow controls, Machine components, Solenoids.

1. Introduction

1.1 Basic Pneumatic System

In pneumatic system, Compressor increases pressure by reducing its volume as described by gas laws. Pneumatic power pack are considered to be an infinite air source. The compressed air is dried to reduce the humidity and dew point. This is known as primary air treatment. Then it is stored in receiver section[8]. Now the pressurized air can be send from one source to the various locations. The air is piped to circuit through an air filter in order to remove dusts which might harm the pneumatic components such as valves, cylinders.

The pneumatic air then flows through a pressurized regulator which reduces the pressure to the desired level for the particular circuit application. Since air is not good lubricant, pneumatic systems require a lubricator to inject a fine mist into the air discharged from the pressure regulator. [7]

This prevents the wear of parts in the pneumatic components. The air is supplied to the pneumatic actuator, through various pneumatic valves. After necessary work is done in the actuator, the air is exhausted.

Since pneumatic systems exhaust air directly into the atmosphere, they are capable of generating excessive noise. Therefore, mufflers are mounted on the exhaust ports of air valves and actuators to reduce the noise.[1-4]

1.2 Objective of the Project

The objectives of this project are,

- ✓ To design a predetermined time delay circuit .
- ✓ To delay the return stroke of piston movement in circuit system

1.3 Scope of the project

In certain engineering application, a predetermined time delay may be required to actuate the pilot DCV, for an example pneumatic cylinder actuates a material handling perform. At the end of the extension stroke, the platform has to wait for predetermined time for removal of material and then it has to return back. For such application, a time delay valve is an ideal solution. [5-10]

2. Description of Components

The circuit shown is used for achieving the following operations, they are,

- Fast forward
- Flow control
- Return stroke time delay.

This circuit made use of various components, they are

- Cylinder
- FRL unit
- 3/2 push button valve,
- Roller pilot operated valve ,
- 3/2 dc pneumatic valve
- 4/2 dc pneumatic valve
- Flow control valve
- Time delay valve.

2.1 Cylinder

Pneumatic cylinders were a mechanical devices which uses the power to compress gas to produce a force in a reciprocating linear motion.[3]

Similarly hydraulic and pneumatic cylinders uses the saved potential energy of a fluid, in this case

compressed air, and convert into kinetic energy as a result air expands in an attempt to reach atmospheric pressure. This air expansion forces a piston to move in the desired direction. [11-14]

2.2 Double Acting Cylinder

Double-acting cylinders (DAC) use the force in air to move in both directions as extend and retract strokes. They have two ports to allow air in, one for outstroke and one for in stroke. Stroke length for our design is unlimited; however, the piston rod is more vulnerable to buckling. [15-19]

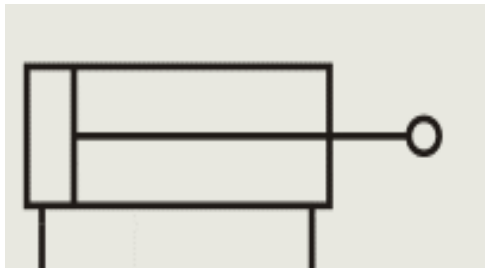


Figure 2.1. Double acting cylinder

2.3 Air Filter

Air flow entering the filter is directed downward with a swirling motion that forces the moisture and the heavier particles to fall down. [11]The role of deflector in the filter separates most of the contaminants before they reach the filter element. The remaining filter foreign particles move along the air and pass through the cartridge where they are arrested[5]. At the bottom of the filter bowl, there is an on-off drain valve, which could be manually opened to the drain the accumulated and particles.[20]

2.4 Pressure Regulator

The Function of this valve is to regulate the incoming pressure to the system so that the desired air pressure is cable of flowing at a steady condition.

The valve has a metallic body with primary and secondary openings. The pressure regulation is obtained by opening the poppet valve to a measured amount for achieving the desired pressure level. This is done by an adjustable screw. The adjusting screw will move the diaphragm upward and thus will make the poppet to unseat, thereby creating an opening to allow air to flow from the primary to secondary side. The opening of the valve and thereby the pressure of air flowing through it will be directly proportional to the compression of the

spring underneath the diaphragm. Larger the opening, greater the pressure and vice versa[20-25]

2.5 FRL Unit

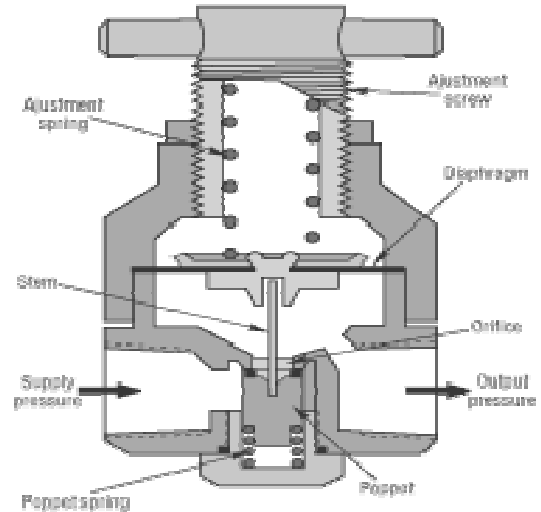


Figure 2.2. FRL Unit

3. Valves

3.1 Control Valves

Control valves are valves used to control conditions such as flow, pressure, temperature, and level of liquid by fully or partially in response to signals received from controllers that compare a base point to a "process variable" whose value is to be provided by sensors that monitor changes in such conditions.

3.2 3/2 and 4/2 Direction Control Operated Valve

The types of valve generally used to operate cylinders and fluid motors in bi direction are four way DCV.

3.3 Pilot Operated Check Valve

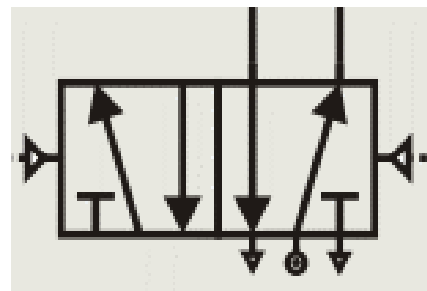


Figure 3.1. Pilot valve

A pilot operated valve is of two way valve. The pilot operated valve is to allow the flow in only one direction and stops the reverse flow until the pressure in the pilot is applied at the pressure port of the valve. [26-30]

3.4 Time Delay Valve

The time delay valve consists of an in built air reservoir, an in built non return flow of control valve and a pilot controlled spring return 3/2 dc valve. This valve is used in an pneumatic system to initiate delayed signal.

Circuit Diagram

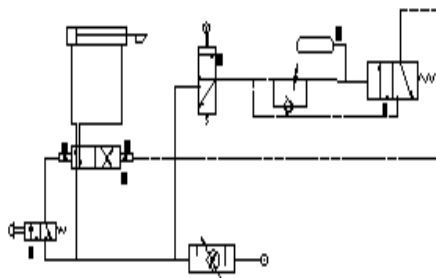


Figure 3.2. Time delay pneumatic circuit

4. Cost Estimation

Table 1. Cost Estimation

S. No	Description	Price
1	Cylinder	1800
2	FRL Unit	1400
3	roller pilot operated valve	630
4	3/2 dc valve	680
5	4/2 dc valve	900
6	Push button valve	820
7	Flow control valve	350
8	Time delay valve	750
9	Poly tubes	160
10	Male connector nuts and bolts	280
11	Plywood and fitting charges	700
12	TOTAL	8470

4.1 List of Components

Time delay circuit consists of the following components to full fill the requirements.

Table 2. List of Components

Sl. No.	Parts	QUANTITY
i.	Wooden board	1
ii.	Cylinder	1
iii.	3/2 dc valve	1
iv.	4/2 dc valve	1
v.	FRL unit	1
vi.	Flow Control Valve	1
vii.	Push Button	1
viii.	Pilot operated valve	1
ix.	Poly tubes	5 mts
x.	Screws	10 nos
xi.	Bolts and nuts	12 nos

4.2 Advantages

- Good tightness and sensitive reaction
- Integrate with the manifold to save installation space
- Switches should be installed on the compressed air supply unit to allow easy and speedy control of air flow.
- In case of a leakage, the compressed air supply unit should be turned off immediately.

4.3 Application

- It can be used in MTC buses
- It also used in automobiles factories
- It also used in pneumatics products companies

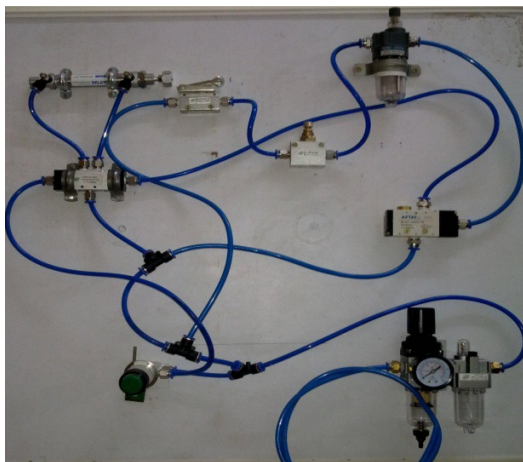
4.4 Snapshot



4A series Solenoid Valves



Double acting cylinder



5. Conclusion

We design and fabricate the time delay circuit for to remove the material in components in a single cycle of time and we delayed the time of the return stroke movement for particular and complicated work piece and achieved in it. It reduces the man power time and setting time.

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