

# DEVELOPMENT OF ELECTRICAL PNEUMATIC CONTROL TRAINER KIT



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# OUTLINE

- Introduction
- Objective
- Scope Of Work
- Methodology
- Literature review
- Conclusion

# INTRODUCTION

- A pneumatic system is a system that uses compressed air to transmit and control energy. Pneumatic systems are power systems using compressed air as a working medium for the power transmission. Their principle of operation is similar to that of the hydraulic power systems. An air compressor converts the mechanical energy of the prime mover into, mainly, pressure energy of the compressed air. This transformation facilitates the transmission, storage, and control of energy. Many factories have equipped their production lines with compressed air supplies and movable compressors.
- Handling of work pieces (such as clamping, positioning, separating, stacking, rotating) , packaging, filling ,opening and closing of doors.

# OBJECTIVE

- Development of electric pneumatic control trainer kit.
- Development of electric pneumatic control trainer kit.
- To reduction in cost of kit.
- Development of automation of paper making bowl machine.
- To reduce labor cost.

# SCOPE OF WORK

- Our main purpose is to use this kit in college practical lab for student practical knowledge.
- Use in automation industries(We apply this system in automation of bowl making machine).

# METHODOLOGY

- START
- LECTRATURE REVIEW
- INFORMATION ABOUT COMPONENT
- FABRICATION
- TESTING
- APPLICATION
- REPORT

# LET RATURE REVIEW

- **(1)Electiro-Pneumatic Actuator**
- **Inventor:-**Assignee: Magnavox Government and Industrial Electronics Company, Fort Wayne Ind.
- **Registration Date:-**4 JULY 1990
- **Patent Number:-**4,942,852
- A bitable electronically controlled pneumatically powered transducer for use, for example, as a valve mechanism actuator in an internal combustion engine is disclosed. The transducer has a piston which is coupled to an engine valve, for example. The piston is powered by a pneumatic source and is held in each of its extreme positions, and air control valves are held in their closed positions by pressurized air and/or permanent magnet latching arrangements and the control valves are released therefrom to supply air to the piston, and the piston is released therefrom to be pneumatically driven to the other extreme position by an electromagnetic neutralization of the permanent magnet field. The piston forms a part of the magnetic latching circuit and that magnetic circuit also includes a radically slotted ferromagnetic member to both complete the magnetic circuit and provide a good air communication path from a high pressure air inlet to the control valve. A pair of auxiliary pistons movable with the piston compress air to a pressure above the pressure of the pneumatic source for aiding recourse of the control valves as well as aiding maintenance of those control valves in their closed positions thereby reducing the size and cost of the latching permanent magnets.
- **(2) ELECTROPNEUMATIC POSITIONER**
- **Inventor:-**Fumio Nagasaka, Tokyo, Japan
- **Registration Date:-**3 AUG. 1999
- **Patent Number:-**5,931,180
- An electro pneumatic positioner includes a data processing control section and an electropneumatic converter. The control section includes first and second position determining sections and a signal setting section. The first position determining section obtains the valve opening degree positions of a regulating valve as the minimum and maximum pressure is set to the minimum signal and the maximum signal. The second position determining section obtains the Valve Opening degree position of the Valve is Set When the driving signal is the minimum signal on the basis of the relative positional relationship between the obtained minimum and maximum valve opening degree positions and the valve plug form of the valve. The signal setting section sets relationship between the maximum and minimum signals A of electrical signals and Valve Opening and Closing directions corresponding to valve opening degrees of the valve.



- **3)DOUBLE-ACTING ELECTROPNEUMATIC POSITIONER**

- **Inventor:-**Mathias Regel,Gruendau Germany

- **Registration Date:-**10 AUG 1999

- **Patent Number:-**5,934,169

- A double-acting electro pneumatic positioner for controlling an actuator, the actuator having a first and second chamber, comprises a single-acting electro pneumatic positioner which provides an output pneumatic pressure to the first chamber of the actuator. A pressure inverter, coupled to the single acting electro pneumatic positioner, inverts the output pneumatic pressure. The inverted output pneumatic pressure is then coupled to the second chamber of the actuator.

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- **(4)ELECTROPNEUMATIC POSITIONER**

- **Inventor:-**Michael Loechner, Filderstadt,Germany

- **Registration Date:-**5 SEPT 2000

- **Patent Number:-**6,112,638

- The present invention includes an electro pneumatic positioner having an external binary input block which provides access to the electrical output of an integral electronic position controller to control operation of a valve relay. The invention enables manual control of the positioner for safety, maintenance etc.

- **( (5)ELECTRO-PNEUMATIC ACTUATOR AND SERVOVALVE FOR USE THEREWITH**

- **Inventor:-**Williham S.Griilin, 112(f)7 8th St.,Manhattan BeachCalif.90266

- **Registration Date:-**31 OCT. 2000

- **Patent Number:-**6,138,458

- An actuator employing an electromagnetic voice coil actuator in parallel With a pneumatic actuator in a Single, integrated unit Rolling diaphragms on the piston are used to minimize sliding static friction, The pneumatic portion of the actuator provides the high forces necessary to support a heavy load and does not become stiff at high frequencies (above 15—20 HZ.), Where the frequency response of the pneumatic portion of the actuator decreases, the voice coil portion takes over and provides the desired high frequency actuation forces, The voice coil does not require a large amount of electrical power, and air How in the go dmg pneumatic actuator provides sufficient cooling of the voice coil. A servo-valve is also disclosed for use with the pneumatic portion of the electro-pneumatic actuator.

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- **(6) ELECTRIC ACTUATOR FOR FLUID CONTROL VALVES**

- **Inventor:-**Floris J\_ Groeneveld, Henge1O(NL)

- **Registration Date:-**16 APR. 2002

- **Patent Number:-**US 6,371,162 B1

- An electro-mechanical actuator for operating afluid control valve and controlling the operation of one or more field instruments, including other valve actuators. An electro mechanical actuator has a drive unit and an electric motor driving the drive unit to open and close a fluid control valve to the fully opened and fully closed states under the control of monitoring limit open and limit closed sensors. Auxiliary control output lines connected to other field instruments from the electro-mechanical actuator drive associated fluid control valves to fully open and fully closed states. Open sensors and limit closed sensors monitor the valve Open and Closed State of the other respective field instruments and through a respective pair of auxiliary travel input lines to the electro-mechanical control the field instrument.

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- **(7) ELECTRO-PNEUMATIC SYSTEM FOR CONTROLLING A DOUBLE-ACTING PNEUMATIC ACTUATOR**

- **Inventor:-**Stefan Kolbenschlag, Darmstadt (DE)DirkKlee,Niederdorfelden

- **Registration Date:-**19 FEB. 2013

- **Patent Number:-**US 8,375,842 B2

- In an electro-pneumatic system for controlling a double-acting pneumatic actuator having first and second working chambers, first and second preliminary pneumatic control components generate first and second preliminary pneumatic Prior Publication Data control signals transferred to respective first and second main pneumatic control components having outputs connected to the respective first and second Working chambers. An electronic splitter circuit precedes the first and second preliminary pneumatic control components for splitting and inverting an electrical control signal input to the splitter circuit around an electrical mean control Value to create first and second mirror-inverted electrical control signals respectively connected to the respective first and second Pneumatic control components. The electrical mean control value is adjustable such that the first and second preliminary control Components respectively generate the respective first and Second Preliminary Pneumatic Control Signals mutually around a pneumatic mean value.

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- **(8)METHOD AND DEVICE FOR OPERATING AN ELECTROPNEUMATIC VALVE**

- **Inventor:-**HeikoKresse, Obernkirchen (DE);StefanTabelander, Herford (DE)

- **Registration Date:-**14 MAY 2013

- **Patent Number:-**US 8,439,329 B2

- The disclosure relates to a method and device for operating an electro pneumatic valve for driving a pneumatic actuator drive to activate things in automation systems. The valve has at least one electro pneumatic transducer and a pneumatic booster. The pneumatic booster has at least one 3/3 Way valve with a blocking center position for optionally connecting an air in how duct or an air out how duct to a connecting duct, which connects to the actuator drive. The ducts are activated as a function of an electrical actuation signal by the electro pneumatic transducer. At least one position of the 3/3 Way valve with a blocking center position is measured and a correction value of a variable of the actuation signal is determined based on the measured value and the electrical actuation signal.

- **(9)ELECTRO-PNEUMATIC LATCHING VALVE SYSTEM**
- **Inventor:-**Mark A. Bennett, Grafton, OH (US);Robert J. Herbst, Avon, OH (US)
- **Registration Date:-**30 SEPT. 2014
- **Patent Number:-**US 2004/0187674 A1
- The electro-pneumatic latching valve system having an electrical switch unit that further includes an “apply” or“a ctivate” switch, a “release” or “deactivate” switch, and a power supply. A first solenoid valve is in electrical communication with the activate switch and a second solenoid valve is in electrical communication with the deactivate switch. A pneumatic latching valve is in pneumatic communication with the first and second solenoid valves and a source of pressurized control and supply air is in pneumatic communication with the pneumatic latching valve and the solenoid valves. A terminal device, e.g. a spring break, is in pneumatic communication with the latching valve, and the device is released or applied in response to pressurized supply air delivered to the device through the pneumatic latching valve in response to pneumatic control signals delivered to the pneumatic latching valve from the solenoid valves.
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- **(10)ELECTROPNEUMATIC VALVE**
- **Inventor:-**HeikoKresse, Obernkirchen (DE);
- Stefan Tabelander, Herford (DE)
- **Registration Date:-**17 DEC. 2009
- **Patent Number:-**US 2009/0309051 A1
- The invention relates to an electro pneumatic valve for driving pneumatic actuator drive to activate settings in automation. The valve has at least one electro pneumatic transducer and a pneumatic booster, Which has at least one 3/3 Way valve With a blocking center position for optionally connecting a connecting duct, Which can be connected to the actuator drive, to at least one of an air in how duct and an air out how duct. The electro pneumatic transducer can be configured to activate the duct(s) in accordance With an electrical actuation signal. The pneumatic booster can include at least one sensor for sensing the position of the 3/3 Way valve With a locking center position, and outputting a signal indicating the sensed position as feedback to the electrical actuation signal.

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# COMPONENT

- FRL
- Manifold 4 way with 4 ball on/off valve
- One way flow control valve
- 3/2 way dc valve with single solenoid
- 5/2 way dc valve with single solenoid
- 5/2 way dc valve with double solenoid
- Limit switches
- Proximity switch
- Silencer
- PLC
- Aurdino controller
- Pick up roll with s.s.rod

# FRL UNIT

- Air leaving a compressor is hot, dirty, and wet—which can damage and shorten the life of downstream equipment, such as valves and cylinders. Before air can be used it needs to be filtered, regulated and lubricated.
- So the FRL is used for filtered , regulated and lubricated



# MANIFOLD

- The manifold bases are large blocks on top of which the valves will fit and attach.
- The manifold is used to distribute the air in different valve.



# FLOW CONTROL VALVE

- Flow control or one-way flow control valves regulate the piston speed of pneumatic drives during advance and return strokes. This is done through suitable restriction of the flow rate of compressed air in exhaust air or supply air direction.



# SINGLE ACTING CYLINDER

- Single acting cylinder is used to convert pneumatic energy to mechanical energy.
- In single acting cylinder air is inlet at one port and it return with spring.
- Bore dia 25mm,Stroke length 100mm, max pressure 10bar.



# DOUBLE ACTING CYLINDER

- Double acting cylinder is used to convert pneumatic energy to mechanical energy.
- In double acting cylinder air is inlet at one port and it return with inlet air in other port.
- Bore dia 25mm,Stroke length 100mm, max pressure 10bar.



# LIMIT SWITCHES NC/NO

- Limit switches is used to control the stroke length of single or double acting cylinder.



# PROXIMITY SENSOR

- Proximity sensor is also used to control the stroke length of cylinder.

# SILENCER

- Silencer is used to reduce the noise of outlet of air.

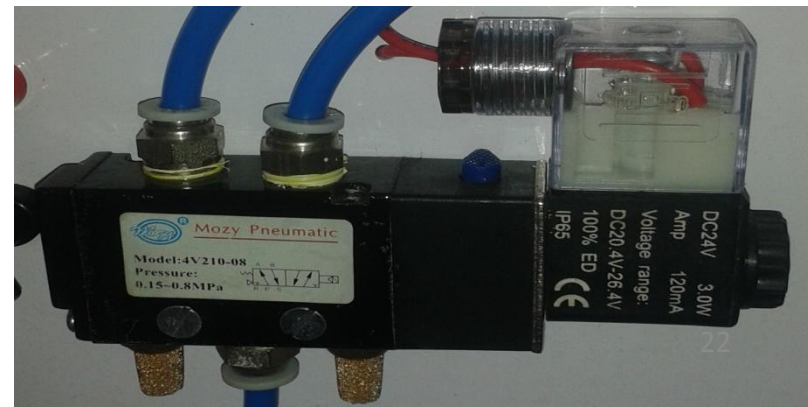
# 3/2 WAY SINGLE SOLENOID VALVE

- 3/2-way single solenoid valve, normally closed.
- When the voltage(12v) is applied the function plate is move and P port is connected with the silencer.
- It is spring return when signal is cut off.



# 5/2 WAY SINGLE SOLENOID

- This 5/2-way single solenoid valve with push-in fittings is bolted onto a function plate which is equipped with a P port and silencer.
- The two electrical connections are equipped with safety connectors. The unit is mounted on the profile plate using a snap-lock system with a blue lever (mounting variant "A")



# 5/2 WAY DOUBLE SOLENOID

- 5/2 way double solenoid control valve is open or closed with double solenoid on or off.



# ARDUINO CONTROLLER

- Arduino is an open-source prototyping platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do so you use the Arduino programming language and the Arduino Software (IDE), based on.





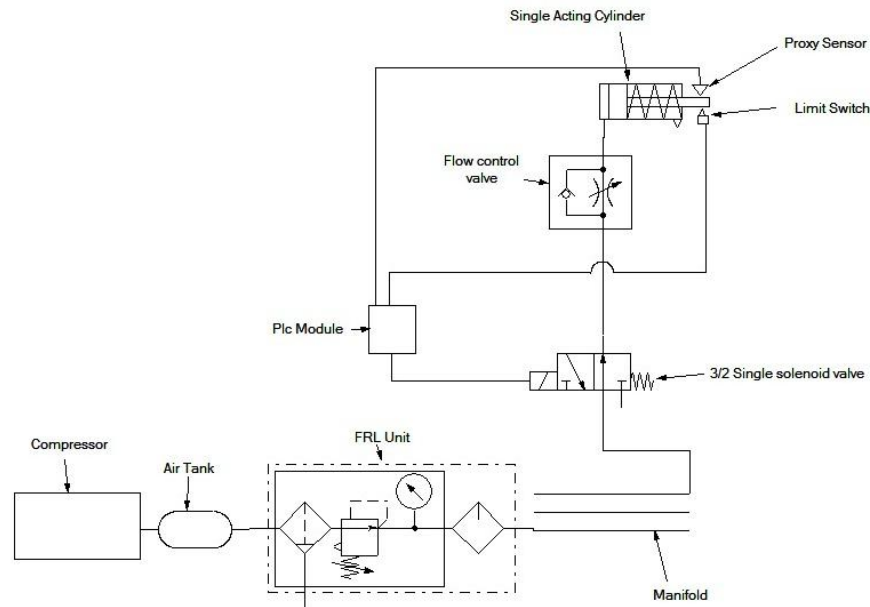
# PICK UP ROLL AND SS ROD

- The material of the pick-up roll is rubber. The pick-up roll is mounted on S.S rod. The pick-up rolls have high coefficient of friction, so they pull the paper from the paper roll.
- The stainless steel rod is used for to support and rotated pick-up roll. The s.s rod is rotated with help of high torque 200rpm D.C motor .The s s rod is supported by the ball bearing at end of the s s rod

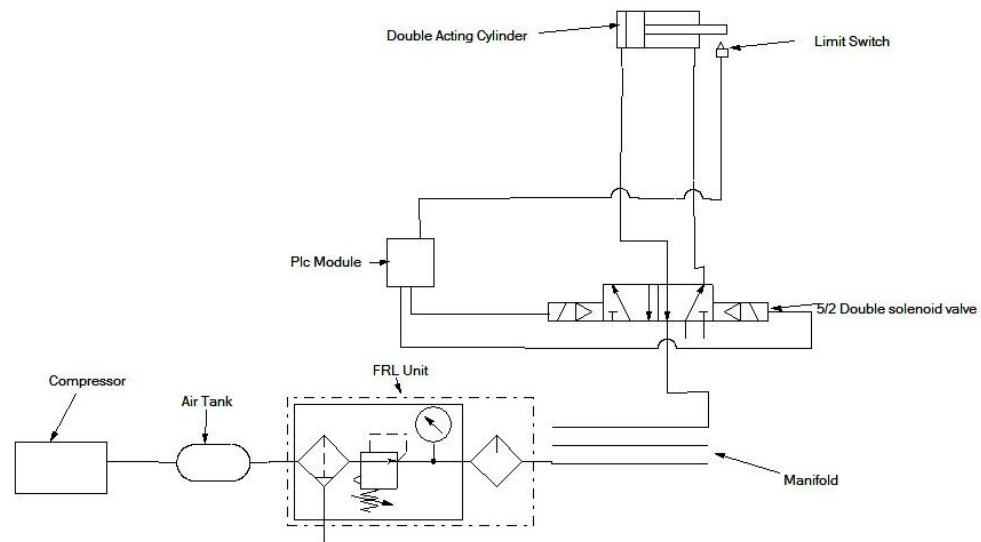


# CIRCUIT DIAGRAM

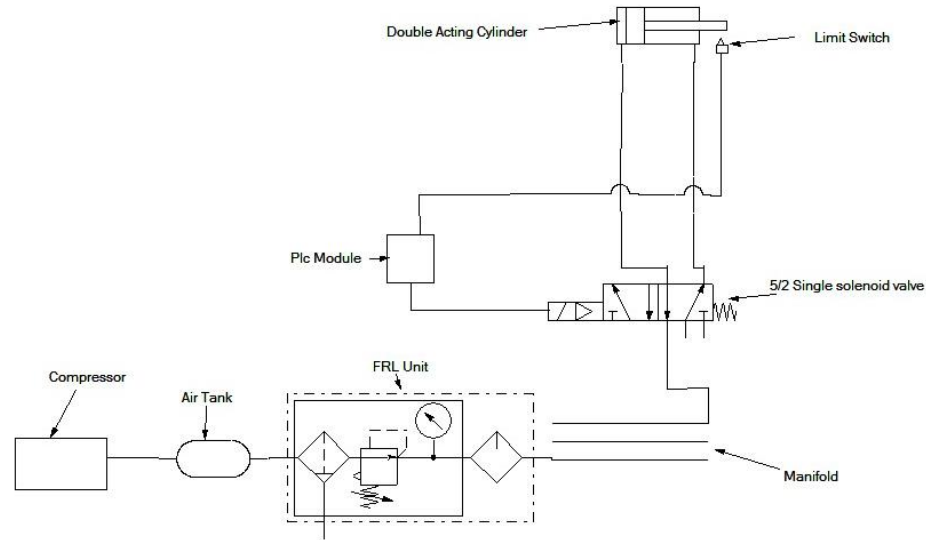
- **How to Operate Single acting cylinder with 3/2 single solenoid control valve.?**



- **How to Operate Double acting cylinder with 5/2 single solenoid control valve.?**



- **How to Operate Double acting cylinder with 5/2 single solenoid control valve.?**



# Development of automation to bowl machine

- For making automation of paper bowl making machine replace the manual pull paper to automatically pull paper.
- For pull in paper we make the pick up roll mechanism.



# CONCLUSION

- On completion of this project, we have learned how to:
- 1. Read and understand pneumatic circuit diagrams and to recognize international standards.
- 2. Recognize electrical components and understand their functions.
- 3. Construct simple electro-pneumatic circuits.
- 4. Read and understand circuit diagrams for electro-pneumatic controls.
- 5. Design circuits for the control of multi-actuator systems.
- 6. Understand the function, design, technical data and symbols for electronic sensors.
- 7. Include timer functions in control circuits.

# REFERENCES

- Designing and Fabrication of Electro-Pneumatic Trainer Kit Kanwar J.S Gill, Roshan Kumar, Sushil Kumar Department of Mechanical Engineering, Gulzar Group of Institutes, Ludhiana, Punjab, India
- Published in L.M. Camarinha-Matos, Hamideh Afsarmanesh, Heinz-H. Erbe (Ed): Advances in Networked Enterprises, Kluwer, 2000, pp 249-258

Thank you