Strictly For Writing (Neat &Clean)

Note: 1] On LHS Page Draw Circuit Diagram (with pencil & scale) and write Corresponding Description of on RHS Page.

2] Start description of <u>each circuit</u> on fresh page.-[<u>Strictly follow this point]</u>

3] Simulate all circuits with fluid sim software and attach copy of same (circuit title, name of student, and roll number) adjacent to hand drawn diagram

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Title: Study of Pneumatic Circuits

Introduction:

A pneumatic circuit is formed by number of components such as valves; cylinders are linked together with the help of pipelines. Like the hydraulic circuits pneumatic circuits are also drawn symbolically. The main difference between the hydraulic circuits and pneumatic circuits is pneumatic circuit do not require return line as air after used is exhausted to atmosphere. Exhaust compressed air from pneumatic components creates a lot of noise. Therefore all pneumatic components are to be provided with noise reduction air mufflers. Mufflers help to maintain noise level at tolerable limits.

Following are basic components used in pneumatic system.

1) Compressor: To compress air at atmosphere pressure to desired pressure

2) Air Tank: To store given volume of compressed air.

3) Electric Motor/other prime mover: To drive compressor.

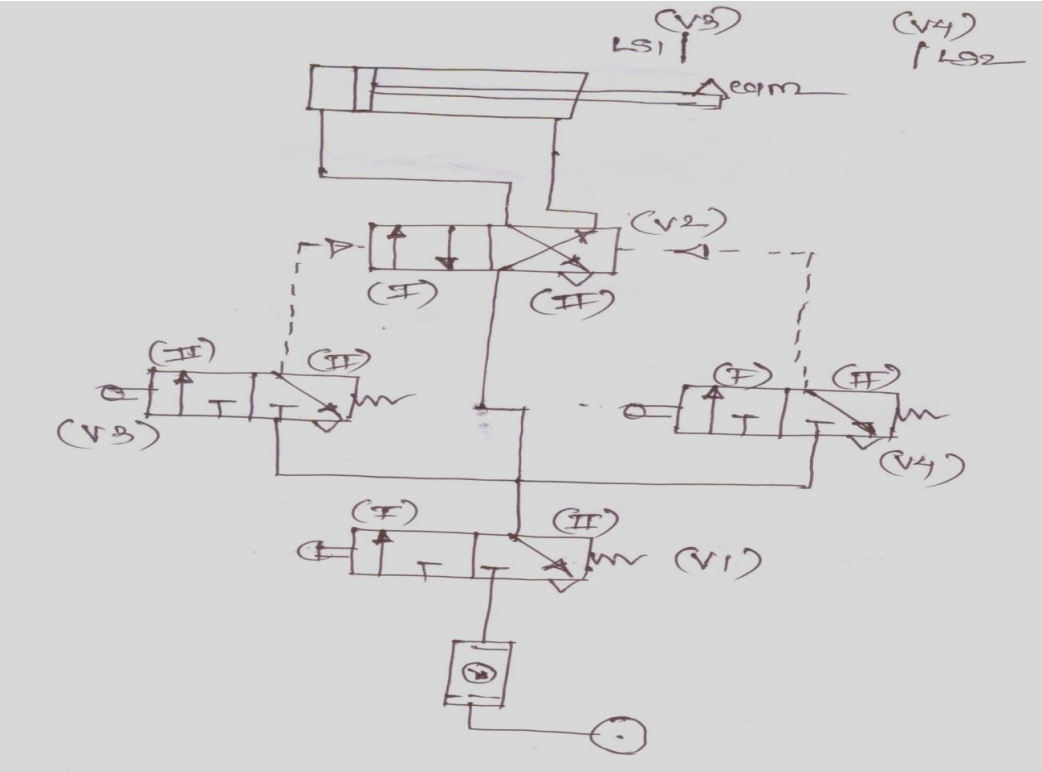
4) Valve: To control air direction, flow rate, pressure.

5) Actuator: To provide linear or rotary motion.

6) Piping: To carry pressurized air from one location to another.

Some standard pneumatic circuits are discussed in further literature.

1] Automatic Cylinder Reciprocating Circuit



DCV used in this circuit (Fig 2) can be specified as under –

Valve (V1) - 3/2 spring return push button operated DCV

Valve (V2) – 4/2 Pilot operated DCV

Valve (V3) - 3/2 Roller operated spring return DCV

Valve (V4) - 3/2 Roller operated spring return DCV

Valve (V1) gives supply air to valves (V3), (V4) & (V2) when it is in position (I) Valve (V2) is used to control or change stroke of cylinder. When (V2) at position (I) the cylinder extension stroke is possible and when (V2) at position (II) cylinder retraction stroke.

When valve (V1) is in position I extension stroke of the cylinder can be achieve by giving pilot signal from valve (V3) to actuate (V2) & retraction stroke can be achieve by giving pilot signal from valve (V4) to operate (V2). To give pilot signal to valve (V2) it is necessary that either V3 or V4 shifted to position (I).This can be achieved by limit switches (LS1 or LS2).LS1 is to actuate (V3) & LS2 is to actuate (V4).

When piston reaches at extreme position during extension stroke, cam actuates LS2 which changes (V4) to position (I) hence V2 get pilot from V4.Therefore (V2) shifted to position (II).Thus retraction of cylinder starts. When piston reaches extreme position during retraction stroke cam actuates LS1 so V3 shifted to position (I).So V2 get pilot signal from V3.Therefore V2 shifted to position (I).Thus one cycle (extension ,retraction) is complete. This cycle repeats until V1 is in position (I).

Such automatic reciprocating of cylinder used to operate long cylinder in particular sequence depend on necessity of tool, jigs & fixture & work movement in machine.

Quick Exhaust Valve

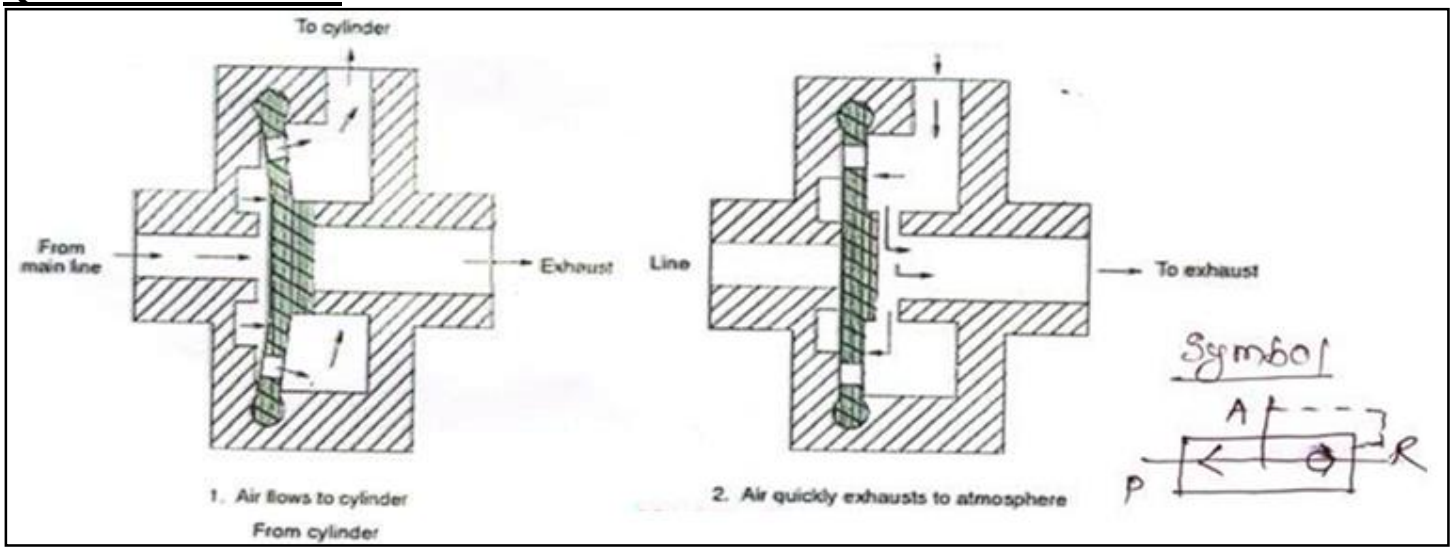


Fig 3: Quick Exhaust Valve

In case of pneumatic circuit FCV are used in order to reduce actuator speed over speed. But to induce higher speed of actuator in pneumatic valve is also possible by using special valve name as quick exhaust valve. Increasing speed of actuator can be achieved by avoiding exhaust air to pass through the direction control valve (DCV) from cylinder so that air energy can act quickly. Air fed to piston side (blank end) of cylinder & air in the rod end side of cylinder can be exhausted to atmosphere quickly by using quick exhaust valve.

Fig 3 shows quick exhaust valve with port P, port A & R. Air flowing to cylinder from DCV will pass to port P & from port P it will pass to port A to actuator. But exhaust air from actuator (cylinder) will exhaust through A & R to atmosphere **without** travelling port P, thus avoids DCV as in normal ease. In this way resistance to piston movement is eliminated proportionately by that amount of less resistance.

Shuttle Valve

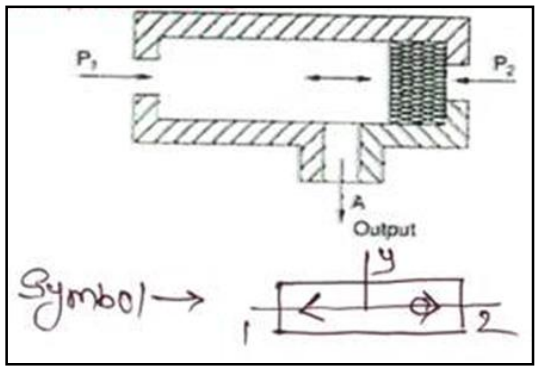
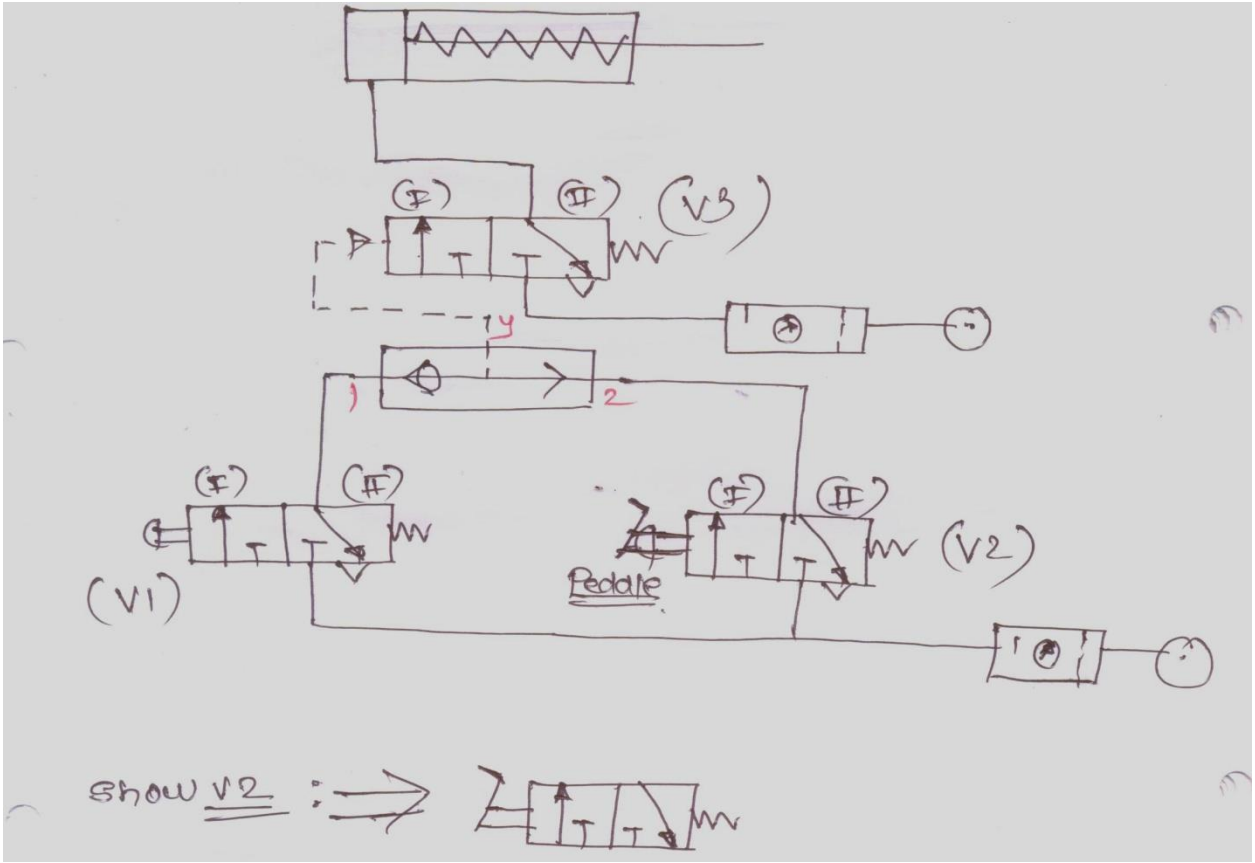


Fig 4: Shuttle Valve

This valve consists of synthetic ball or valve element moving inside bore on valve housing with three opening P1, P2 & A as shown in Fig 4. If air is fed simultaneously to port P1 & P2 then air moves to port A either from P1 or P2 depend on valve of P1 & P2.

If air fed from P1 only then ball moves & closes port P2 & air passes to port A. If air is fed from port P2 only then port P1 is closed & air moves to A. In this way, either of input (P1 or P2) is given will get output A. Hence it can be used as equivalent component for OR Gate.

2] Shuttle Valve Application



This circuit consists of single acting cylinder, shuttle valve and three 3/2 DCV with different method of operation. (Fig 6)

For this circuit valve specifications are as follows:

Valve 1 (V1) 3/2 push button operated spring return DCV

Valve 2 (V2) 3/2 pedal operated spring return DCV

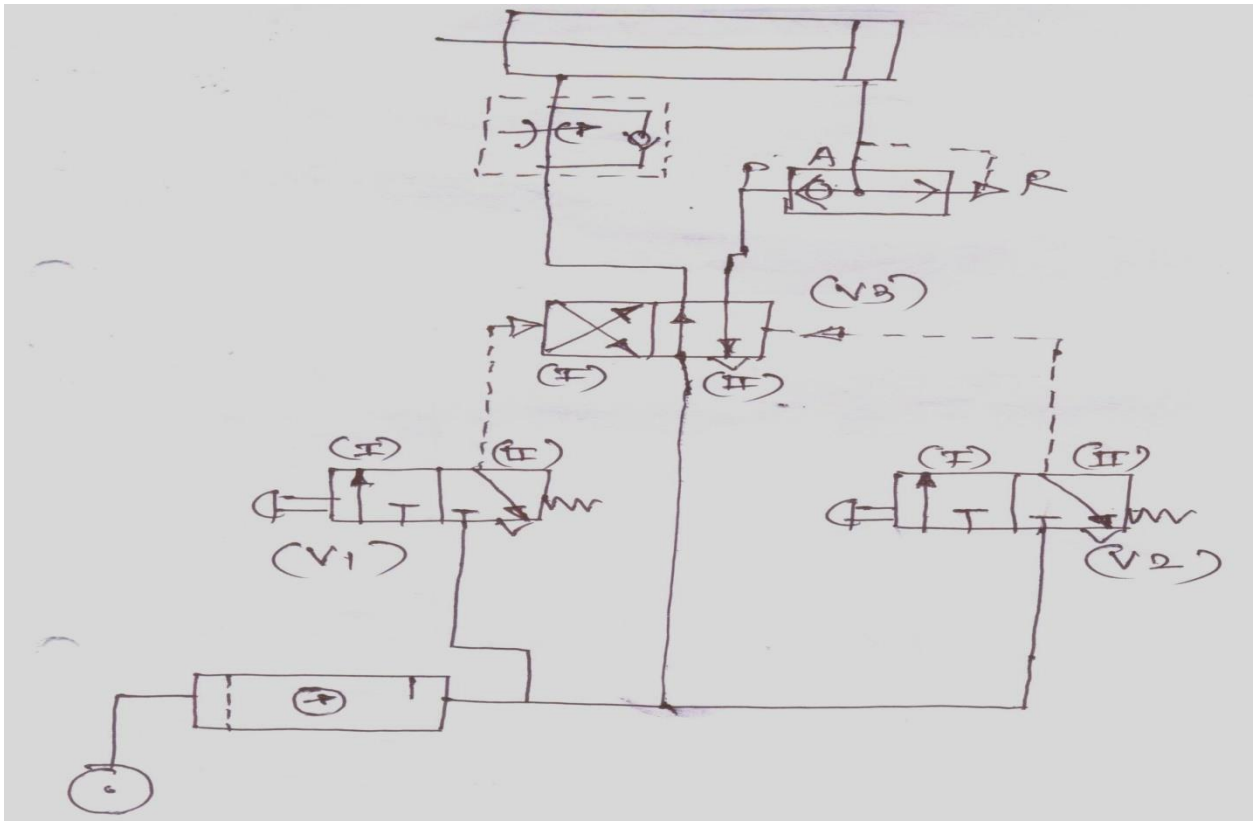
Valve 3 (V3) 3/2 pilot operated spring return DCV

The main working of this circuit is when either of valves V1 or V2 is operated & cylinder is extended. In this circuit the single acting cylinder can be actuated by two methods of operation either by push button or pedal. This is possible by using shuttle valve hence this circuit is equivalent to OR gate.

When valve V1 is operated by push button, valve V3 gets pilot signal through shuttle valve & it change to position I hence cylinder extends. Similarly when valve V2 is operated by pedal, valve V3 gets pilot signal through shuttle valve & it changes its position to (I) hence cylinder extends. As single acting cylinder is used so when valve (V3) returns to position (II) cylinder retracts because of spring force.

In this way cylinder can be actuated either by using valve V1 (push button) or Valve V2 (pedal).

3] Slow Forward and Rapid Return Cylinder



In this circuit throttle out circuit (Fig 7) is used at rod end side and quick exhaust valve used at blank end side of double acting cylinder. Valve (V1) and (V2) are 3/2 push button operated spring return DCV. Valve V3 is pilot operated 4/2 DCV. Pilot signal to V3 is given by V1 or V2.

When V1 is actuated by push button valve V3 gets pilot signal and it shifted to position I. Hence double acting cylinder start extending but it is control flow through FCV (it is also called as throttle out control). Therefore slow forward motion of the cylinder.

When V2 is actuated by push button valve V3 gets pilot signal and it is shifted to position II. In this condition flow of air is to rod end side through check valve hence unrestricted flow to the cylinder. Air exhaust from blank end is through quick exhaust valve. Hence exhaust air from piston side of cylinder is directly exhausted to atmosphere by using quick exhaust valve. Hence double acting cylinder return rapidly.

In this by using throttle out arrangement and quick exhaust valve Slow Forward and Rapid Return of double acting Cylinder is possible.

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