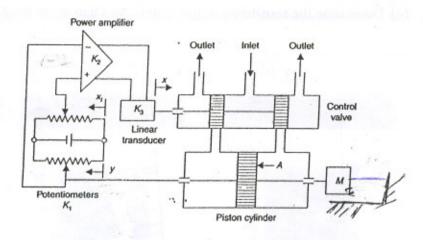
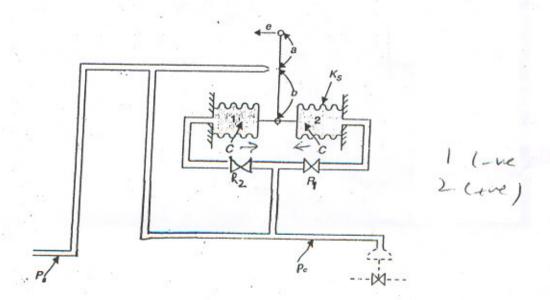
Q1. The electro hydraulic position control system, shown in figure below positions a mass mass M. Assume that rate of oil flow to the piston is $q = K_V x - K_r p$, where Valve coefficient is k_V , area of piston is A, supply pressure is p, K_r is a constant and x is the valve opening. Draw the block diagram of the system and determine the transfer function $Y(s)/X_i(s)$.



- Q2. A 4-stack stepper motor has 30 numbers of teeth; assuming that stack rotor teeth align with its stator, calculate the angular displacement between stacks of stator teeth.
- The schematic diagram of a pneumatic controller is given below. Draw the block diagram of the system and determine the transfer function $P_c(s)/E(s)$. Flapper nozzle valve coefficient is K_f .



QL Level in the tank is to be controlled using a hydraulic controller as given below. It is given that ΔQ_i , changes proportionately to the change in the piston displacement Δy ($\Delta Q_{i=-}$ K Δy , i.e. when Δy moves upward it closes the valve reducing ΔQ_i). Make connections of port A to C or D and B to C or D so that system works in negative feed back mode. Assume that the capacity of the tank is C, valve coefficient is K_v , Area of the piston is A and piston is leakage free. For this system:

- (a) Draw the block diagram
- (b) Obtain the transfer function $\Delta H(s)/\Delta Q_d(s)$
- (c) Determine the sensitivity of the system for changes in the K for $\omega = 0$ rad/sec

