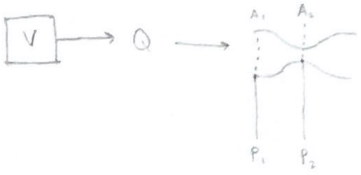
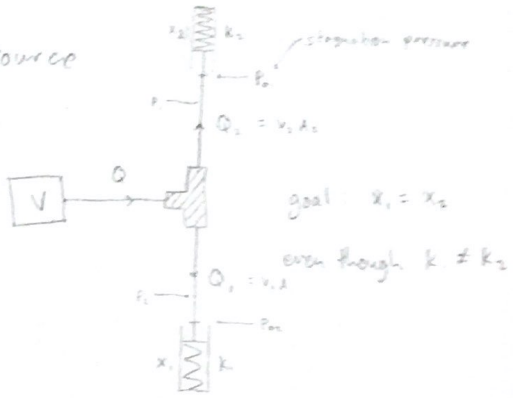
Ideal ventilator: volumetric flow-rate source





Venturi effect: $P_1 - P_2 = \frac{\rho}{2}\left(V_2^2 - V_1^2\right)$ $\quad Q = v_1 A_1$

$$Q_1 = A_1\left[\left(\frac{2}{\rho}\right)\frac{P_1 - P_2}{\left(\frac{A_1}{A_2}\right)^2 - 1}\right]^{1/2}$$

assuming constant areas: $Q(P_1, P_2) = \left[\frac{\rho}{2}\cdot\frac{\left(\frac{A_1}{A_2}\right)^2 - 1}{A_1^2}\right]^{-1/2}\sqrt{P_1 - P_2}$

$Q^2 \sim P_1 - P_2$

$$= \left[\frac{\rho}{2}\left(\frac{1}{A_2^2} - \frac{1}{A_1^2}\right)\right]^{-1/2}\sqrt{P_1 - P_2}$$

$$Q(P_1, P_2) = f(A_1, A_2)\sqrt{P_1 - P_2}$$

$Q_1 = f_1\sqrt{P_1 - P_2}$ $\quad Q_2 = f_2\sqrt{P_3 - P_4}$

$P_{01} A_1 = k_1 x_1$

$Q = v_1 A_1$

$P_{01} = P_1 + \frac{1}{2}\rho v_1^2$

$k_1 x_1 = \left(P_1 + \frac{1}{2}\rho v_1^2\right)\frac{Q_1}{v_1}$

$k_2 x_2 = \left(P_2 + \frac{1}{2}\rho v_2^2\right)\frac{Q_2}{v_2}$

perfect splitter: $P_1 = P_2$

$Q_1 = Q_2$

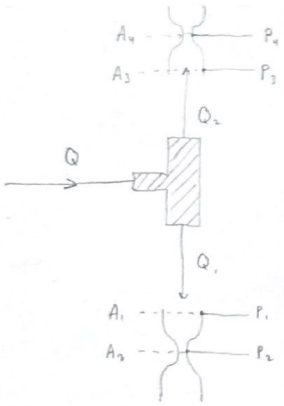
$v_1 = v_2$

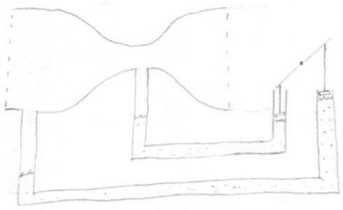
$k_1 x_1 = k_2 x_2$ duh.

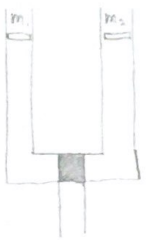
now adjust v_1 and v_2:

$$x_1 = \frac{Q_1}{k_1 v_1}\left(P_0 + \frac{1}{2}\rho v_1^2\right)$$

$$x_2 = \frac{Q_2}{k_2 v_2}\left(P_0 + \frac{1}{2}\rho v_2^2\right)$$







Is it important that the same volume of air goes in both patients' lungs, or that their lungs expand by the same volume?

Dumb question, obviously, these two are always the same.

1. We venturi tubes to sense volumetric flow rate
2. We that information to throttle flow splitting