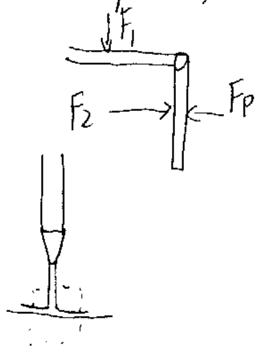
PAUTA AUX #7

P1) En la compuerta, $\Sigma \vec{T} = 0$: $F_1\cdot\frac{2L_1}{3} + \frac{F_2\cdot L_2}{2} = F_P\cdot X$ (1)



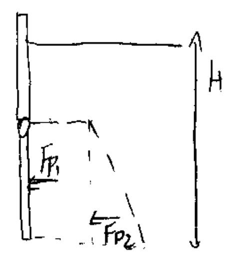
F_1 y F_2 se calculan por medio del TCM

$$\Sigma F_{ext} = F_1 = \rho Q_1 (V_s - V_e) = \rho Q_1\left(0 - \frac{-Q_1\cdot 4}{\pi d_1^2}\right)$$

$$\Leftrightarrow F_1 = \frac{4\rho Q_1^2}{\pi d_1^2}$$

Análogamente, $F_2 = \frac{4\rho Q_2^2}{\pi d_2^2}$

Hidrostática: Descomponemos el prisma de presiones y obtenemos:



$$F_{P_1} = \gamma\cdot B\cdot(H-L_2)L_2 \; ; \; X_1 = \frac{L_2}{2}$$

$$F_{P_2} = \frac{\gamma}{2}BL_2^2 \; ; \; X_2 = \frac{2}{3}L_2$$

Reemplazando en (1): $\frac{4\rho Q_1^2}{\pi d_1^2}\cdot\frac{2L_1}{3} + \frac{4\rho Q_2^2}{\pi d_2^2}\cdot\frac{L_2}{2} = \frac{\gamma B(H-L_2)L_2^2}{2} + \frac{\gamma B L_2^3}{3}$

$$\frac{4\rho}{\pi}\left(\frac{2Q_1^2L_1}{3d_1^2} + \frac{Q_2^2L_2}{2d_2^2}\right) - \frac{\gamma B}{3}L_2^3 = \frac{\gamma B(H-L_2)L_2^2}{2} \Leftrightarrow H = L_2 + \frac{8\rho}{\gamma\pi B L_2^2}\left(\frac{2}{3}\frac{Q_1^2L_1}{d_1^2} + \frac{Q_2^2L_2}{2d_2^2}\right) - \frac{2}{3}L_2$$

$$\Rightarrow H = 1{,}2 + \frac{8\cdot 1.000}{9.800\pi\cdot 1\cdot 1{,}2^2}\left(\frac{2}{3}\cdot\frac{0{,}047^2\cdot 2}{0{,}05^2} + \frac{0{,}031^2\cdot 1{,}2}{2\cdot 0{,}05^2}\right) - \frac{2}{3}\cdot 1{,}2 = 0{,}65 < L_2$$

$H < L_2 \Rightarrow$ Rehacemos el cálculo hidrostático $\Rightarrow F_P = \frac{\gamma}{2}\cdot B\cdot H^2$; $X = L_2 - \frac{H}{3}$

$$\Rightarrow \frac{4\rho}{\pi}\left(\frac{2}{3}\frac{Q_1^2L_1}{d_1^2} + \frac{Q_2^2L_2}{2d_2^2}\right) = \frac{\gamma BH^2}{2}\left(L_2 - \frac{H}{3}\right) \Leftrightarrow H^2\left(L_2 - \frac{H}{3}\right) = \frac{8\rho}{\pi\gamma B}\left(\frac{2}{3}\cdot\frac{Q_1^2L_1}{d_1^2} + \frac{Q_2^2L_2}{2d_2^2}\right)$$

$$\Leftrightarrow H^2\left(L_2 - \frac{H}{3}\right) = \frac{8\cdot 1.000}{\pi\cdot 9.800\cdot 1}\left(\frac{2}{3}\cdot\frac{0{,}047^2\cdot 2}{0{,}05^2} + \frac{0{,}031^2\cdot 1{,}2}{2\cdot 0{,}05^2}\right) \Leftrightarrow \underbrace{H^2\left(1{,}2 - \frac{H}{3}\right)}_{A} = 0{,}366$$

Iterando $\Rightarrow H=0{,}65 \rightarrow A=0{,}415$; $H=0{,}6 \rightarrow A=0{,}36 \Rightarrow H=0{,}6$

b) Ahora, el balance de torques queda como: $\dfrac{4\rho Q_1^2}{\pi d_1^2} \cdot X = \dfrac{\gamma B H^2}{2}\left(L_2 - \dfrac{H}{3}\right)$

$$\Rightarrow X = \frac{\gamma B \pi H^2 d_1^2}{8\rho Q_1^2}\left(L_2 - \frac{H}{3}\right) = \frac{9.800 \cdot 1 \pi \cdot 0{,}6^2 \cdot 0{,}05^2}{8 \cdot 1.000 \cdot 0{,}047^2}\left(1{,}2 - \frac{0{,}6}{3}\right) = 1{,}59\,[m]$$