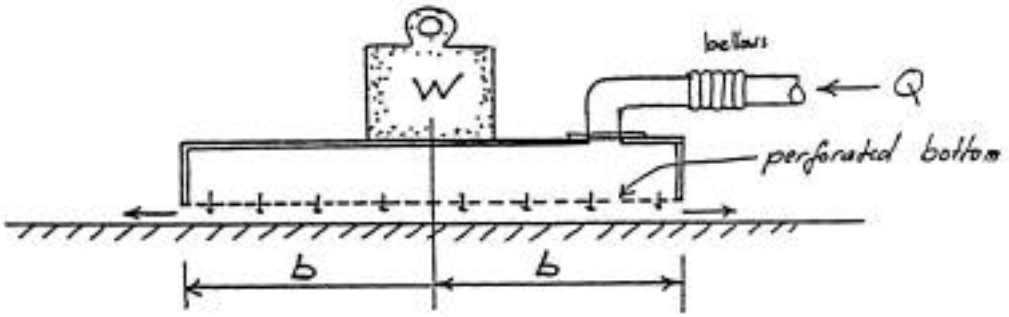
Problem 5.12

Hovering platform



The sketch shows a hovering platform of half-width *b* and length *L*, the latter being large compared with *b*. The platform has a perforated bottom through which air is pumped at a steady total volume flow rate *Q*, the air leaving the perforations with a vertically downward velocity that is the same at all holes. The total weight of the loaded platform is *W*.

We are interested in deriving an expression for the height *h* at which the platform supports itself above the ground. It is known that the Reynolds number for the flow in the gap under the platform is very high.

(a) Is Bernoulli's equation applicable in the gap? Explain.

ANSWER

(b) Derive an expression for *h* assuming that that the flow is incompressible and the effect of shear forces on the horizontal flow in the gap is negligible. Express *h* in terms of the given quantities *W, b, L* and the gas density ρ.

HINT HINT 2 ANSWER