The equilibrium of a flexible tape into a vacuum chamber, subject to a pressure difference maintained by external gas sources, is analyzed. A fluid gas film is built up between the tape and the chamber wall, over a distance separating the volumes at different pressures and confined by the flexible and solid boundaries. Therefore, the problem considers stationary walls, one of them with yet unknown shape, to be determined under the effect of variable pressures and fluid flow.

Successively, the cases are considered when either inertia or viscous forces prevail and the theoretical results are compared with experiments carried out by the author. For the inviscid flow, the solution, as presented in the paper, is undetermined, with an arbitrary parameter \( \beta \) (the exit angle). Meanwhile, the curves plotted in Fig. 3 show a high sensitivity with respect to this parameter and merely a qualitative conclusion may be deduced regarding the real contribution of inertia. A supplementary condition, for instance \( \frac{dp}{dx} = 0 \) at \( x = x_2 \), could solve this indeterminacy. However, equation (2) shows then that at this point \( \frac{dV}{dx} = 0 \), too; therefore, the motion downstream \( x = x_2 \) includes a variable pressure \( p_2 \) in the rear region of the vacuum chamber or flow detachment and a more sophisticated pattern, perhaps beyond the goal of this paper.

The diagrams Figs. 3 and 4 show that inertia, albeit lower than viscous forces, may still represent 20-30 percent of viscous effects. Hence a complete solution, including both inertia and viscosity, might improve the differences between theory and experiments, as they appear in Fig. 4, at least for small \( \Delta p_1/\Delta p_2 \) values.

Inadvertently, formula (20) shows the speed \( U \) as a factor. I also found that I could not construct equation (15), the film boundary condition, by using the assumptions given by the author in the paragraph following the equation. Could the author give more detail on the derivation?

The problem dealt with in this paper requires a simultaneous solution of various differential, algebraic, and transcendental equations. In order to obtain simple results, the author introduces proper assumptions which enables him to obtain numerical values. Further analysis of the problem with moving tape and \( \Delta L = 0, L < L_{\text{min}} \) should enhance the value of the present work, for which the author is to be congratulated.

Author’s Closure

The author wishes to thank Professor Tipei for his comments which are well taken. The factor \( U \) which was erroneously included in equation (2) was removed. The derivation of equation (15) follows:

In region 1, away from the lubrication zone, the foil approximates a parabola with curvature \( \Delta p_1/\Delta p_2 = (\Delta p_1/\Delta p_2)/b \) and an unknown minimum point \( (x_m, h_m) \). The equation of this parabola is

\[
h = h_m + \frac{1}{2} \frac{\Delta p_2}{b} (x - x_m)^2
\]
The parabola passes through \((-L, a)\) and hence

\[
a = h_m + \frac{1}{2} \frac{\Delta p_1}{\Delta p_2} \frac{1}{b} (-L_1 - x_m)^2
\]

Subtracting and rearranging:

\[
h - a = \frac{\Delta p_1}{\Delta p_2} \frac{1}{b} (x + L_1) \left( -\frac{x + L_1}{2} + x - x_m \right)
\]

The slope of the parabola is

\[
\frac{dh}{dx} = \frac{\Delta p_1}{\Delta p_2} \frac{1}{b} (x - x_m)
\]

Elimination of \(x_m\) between the last two equations results in equation (20). Equation (20) is applicable also in the limit of \(\Delta p_1/\Delta p_2 \to 0\), in which case the parabola degenerates into a straight line.