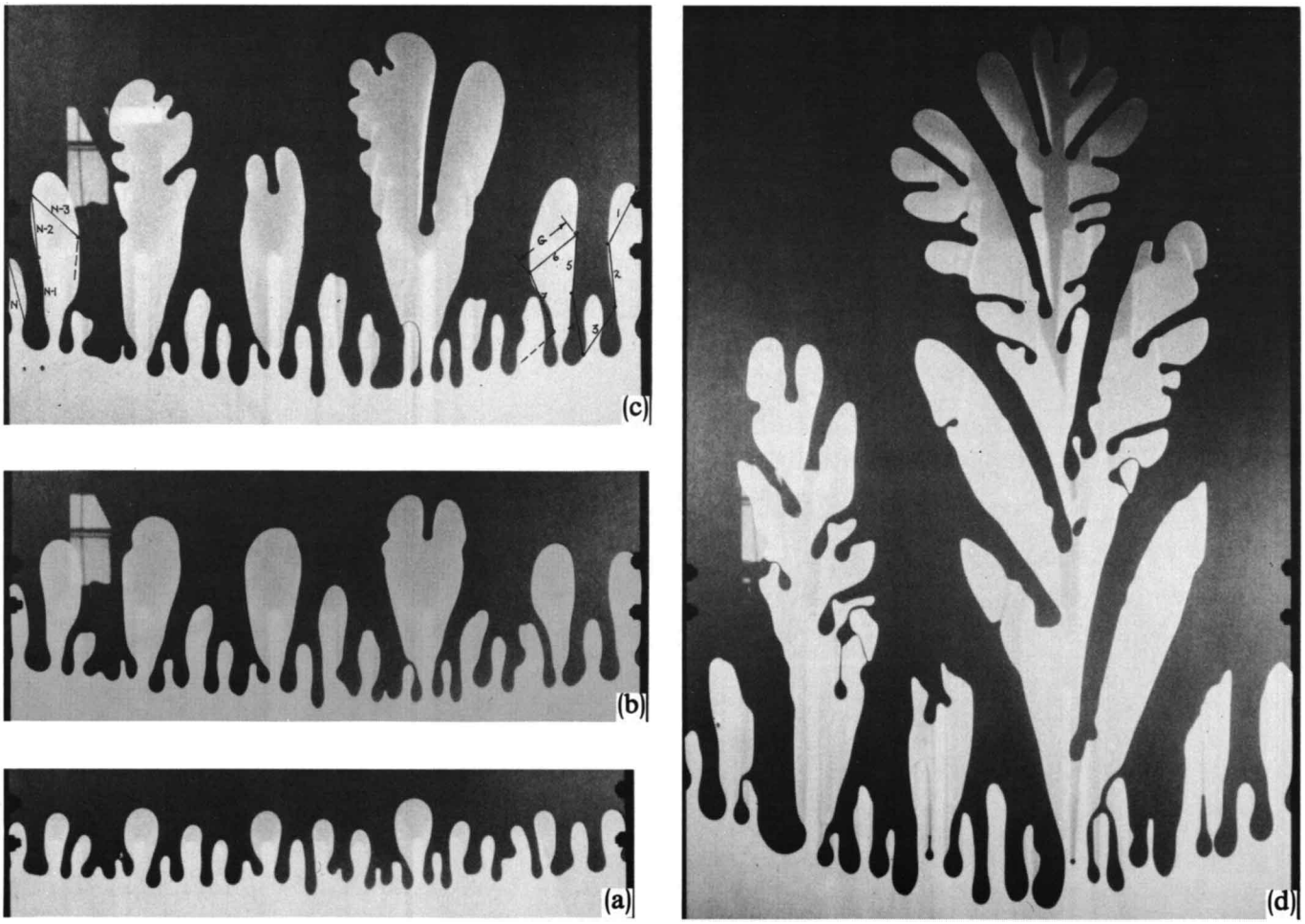

A NOTE ON THE NONLINEAR GROWTH OF A GRAVITATIONALLY UNSTABLE INTERFACE IN A HELE–SHAW CELL

Submitted by T. Maxworthy (University of Southern California)

These photographs show the growth of the gravitationally unstable interface between viscous silicone oil ($\nu = 86$ cS) and air contained in the narrow (0.16 cm) gap between two 1.27 cm thick glass plates with working dimensions 61×120 cm. In this case, the cell was rotated until it was vertical, and approximately thirty unstable waves were formed initially. The fastest growing waves suppressed the growth of their smaller neighbors until only one dominant wave emerged. The growth of the effective interface width scales with the wavelength and the growth rate of the initial instability. Casual observation of a highly contorted interface, such as Fig. (d), which is the result of a number of bifurcations, suggests that the interface may have a fractal dimension. By measuring the number of steps (N) required to cover the interface with a gauge of length (G) [Fig. (c)] and plotting log N vs log G, we determine[10] that the interface is one dimensional for scales less than the instability wavelength (L), but has a fractal dimension of 1.36 for scales between L and $10L$. We suspect that running these experiments in a much larger cell would extend this result to even larger gauge lengths. A manuscript outlining the details of a large number of similar experiments is in preparation.[11]