with C_0 determined to an accuracy of one part in 10^7 for diameter ratios of 0.1 to 0.95. (Note that numerical errors in Smythe's earlier paper are corrected in a later paper.[4])

In Fig. 1 we compare the various expressions for F by plotting $(F-1)$ as a function of $(d/D)^3$ on logarithmic coordinates. Also shown is the semiempirical equation presented by DeBlois and Bean as the best fit[6] (at small diameter ratios) of their experimental results,

$$F_6=1+0.73(d/D)^3. \quad (6)$$

This figure shows that (1) Smythe's numerical results F_5 agree well with the experimental data F_6 at small $(d/D)^3$; (2) DeBlois and Bean's limiting theory F_4 does not coincide with F_5, as $(d/D)^3\rightarrow 0$; and (3) F_3 converges with the numerical results as $(d/D)^3\rightarrow 1$, the error being less than -8% in F at $(d/D)^3=0.86$. Table I compares representative F values obtained from Eqs. (4)–(6).

Smythe also presents calculations for spheroids of eccentricity $\frac{1}{2}$ (prolate) and 2 (oblate), the axis of revolution coinciding with the pore axis. His results are unreliable for the prolate spheroid as $(d/D)^3\rightarrow 1$ because of convergence problems; however, in this region one can use the results obtained from an area integration [the basis of Eq. (3)] to obtain

$$F_7=\frac{1}{\epsilon}(D/d)^3\left\{\frac{\sin^{-1}(d/D)}{[1-(d/D)^2]^{\frac{1}{2}}}-\frac{d}{D}\right\}, \quad (7)$$

where d is the diameter of revolution. One can show[7] that any potential function Ψ that is continuous in $\nabla\Psi$ and equal to the exact solution Φ far from the particle will give rise to a current distribution which has an energy dissipation greater than or equal to that of the true solution. Thus, the exact solution Φ will give the maximum resistance (i.e., F), and hence, Eq. (7) will always be smaller than the true solution, converging to the true value as $(d/D)^3\rightarrow 1$. [For an oblate spheroid of $\epsilon=2$, Eq. (7) yields a value of F only 5.3% below Smythe's numerical result for $d/D=0.95$.]

Finally, mention should be made of the assumption that the particle (spheroid) travels on the center line. Happel and Brenner[8] state that there is no preferred path for a particle traveling through a pore, and because of Brownian motion, the exact result for F must include all orientations and radial positions for the particle. However, Fig. 1 indicates that the analytical model (F_5) describes the system reasonably well, at least for spheres, for which there are no orientation effects.

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TABLE I. A numerical comparison of the theory of DeBlois and Bean F_4 with Symthe's analysis F_5, and DeBlois and Bean's fit of their experimental results F_6.

$(d/D)^3$	F_4	F_5	F_6
0.001	1.001269	1.000797	...
0.005	1.006369	1.004008	1.0036
0.010	1.012797	1.008055	1.0073
0.050	1.066325	1.041728	1.036
0.100	1.14	1.087354	1.073
0.500	2.31	1.686712	1.36

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[6] Note that the pore diameter in DeBlois and Bean's membrane was determined by matching their theoretical equation (F_4) to their measured resistive pulses for a range of particle diameters. If F_5 were used to fit the experimental results the coefficient in F_6 would probably show a slight change, and, hence, the agreement between F_5 and F_6 in Fig. 1 would reflect this change.
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Subnanosecond Switch for Use in Shock Wave Experiments*

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A SUBNANOSECOND selenium switch has been developed for use in shock wave experiments (see Fig. 1). Bulk selenium makes a transition to the metallic state at a pressure of 128 kilobars, with a resistivity decreasing by a factor of about 10^{11} from the value at atmospheric pressure.[1,2] A shock wave traversing the selenium film in a direction normal to the film induces the transition.

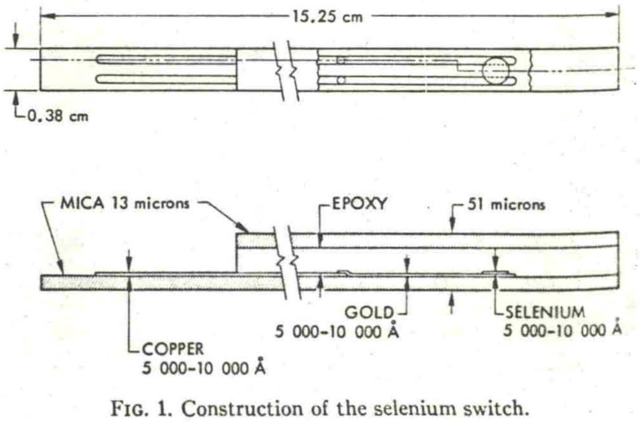

FIG. 1. Construction of the selenium switch.