The properties of Wilkeson sandstone have been determined only partly by independent measurement. The estimate $\mu_r = 1.0$ has been inferred from [10], page 178, and seems to be a reasonable average for rocks. The shear strength τ_o has been deduced from a compression test, in which a cubic-inch sample failed at 4500 psi. Jaeger and Cook [10] show that the failure criterion (18) implies a ratio of compressive to shear strength equal to

$$2[(\mu_r^2 + 1)^{1/2} + \mu_r] ,$$

which equals 4.8 when μ_r is unity. Thus $\tau_o \approx 1000$ psi, a reasonable value for a moderately soft sandstone. The grain diameter g was measured very roughly by micrometer. The estimate for the permeability k of Wilkeson sandstone is the result of unabashed curve fitting. No means were available to measure k independently during the first crude experiments, so the value 8.6×10^{-5} (in/sec)/(psi/in) was determined by fitting the asymptotic expression (30) to the values of h measured at high v.

It is worth saying a few words about k at this stage, because permeability will play the major role in the economics of hydraulic rock cutting. k depends on the viscous drag of fluid squeezing through the interstices between grains. The viscosity of the fluid can be eliminated through the formula

$$k = k'/\eta ,$$

where k' depends on the rock alone and has the dimensions of an area. To some extent the grain structure can be eliminated as well:

$$k = k^* g^2/\eta \quad , \tag{31}$$

where k* is dimensionless. Equation (31) conveys the useful implication that slot depth at high v is directly proportional to grain diameter g, rather than inversely proportional as (30) suggests. The length relevant to permeability is the gap between grains rather than their diameter, however, so k* must be very small. Under the present assumptions about Wilkeson sandstone, for example, $k^* = 6.5 \times 10^{-7}$. The permeability k thus depends upon imperfections in grain alignment. Like electrical conductivity, also dependent upon imperfections, k varies over an enormous range, by a factor of 10^5 among rocks according to Table 2.2 of [11]. In that table the permeability of "sandstone" is given as 0.2 to