Tillage to promote seed germination and plant growth is one of the oldest branches of agriculture and seemingly has reached a high degree of development. Even so, the equipment and methods of use have for the most part been developed empirically. As a result, no measure that will enable explaining the optimum condition for crop production has been worked out. This lack of a measure has produced a chaotic condition in literature on both the agronomic and engineering phases of the use of tillage machinery. We find, for example, that it is not possible to correlate tests of tillage equipment made at different locations or at different times in the same location, though often the soils and soil conditions may be described to indicate that they are practically identical.

Agronomists, soil scientists, and agricultural engineers are conscious of the need for a measure or measures to enable describing soil conditions found and/or produced. This need is not realized, however, by all lay writers as is plainly illustrated by the fact that in one publication (18) with wide distribution, an illustration simulating plow action under a sod condition is used to explain how the plow pulverizes the soil. It is stated that the soil tends to segregate into layers parallel to the soil surface which slide over each other as might be illustrated by bending the pages at the corner of a book. Further pulverization is explained as due to the bending of these layers of soil to cause them to conform to the moldboard. Carefully conducted tests show that this condition exists only where there is a sod or an extremely hard crust 1 to 3 inches thick.

Realizing the lack of both measures for determining the dynamic properties of the soils and the means for comparing the performance of tillage tools under comparable and controlled conditions of both the soil and the tool, a series of studies was instigated at the Alabama Polytechnic Institute, Auburn, Ala., to determine some of the soil and tool design factors that affect the operation and effectiveness of the soil-working tool. The results of this study have been published by Nichols and others (4, 5, 6, 7, 8, 9, 10). They show the effects of colloidal films, shear values for certain soils, effect of soil factors on soil and metal friction, both soil and design factors affecting scouring, and the true reaction of soils over moldboard surfaces.

One phase of this study shows the true pulverizing action of the moldboard plow or, for that matter, any rigid soil-working tool. Nichols and Reed (10) found that the plow acts as a double wedge entering the soil. Pressure is exerted both upward and toward the open furrow. This sets up a stress in the soil that blocks of soil to be sheared loose on shear planes in the furrow slice as it moves up the moldboard, forming shear planes at right angles to the initial planes (secondary), as shown in Fig. 2.