This paper is in the nature of a second chapter to one presented earlier (1). In that study the water infiltration process was examined in laboratory packed columns of texturally uniform, air-dry soils. In the present study the same laboratory packed soils were used, but this time two different initial soil conditions were investigated. First, columns of the Yolo sandy loam and silt loam, described in the previous paper, were subjected to infiltration after having been irrigated and drained so as to raise their initial moisture contents. Second, layered columns of the two soils were used and infiltration was studied in one case with the sandy loam above and, in the other, below the silt loam. In this and the previous study the object has been to seek an explanation of the observed relationship between infiltration rate and time, based upon those conditions of soil moisture energy which can be measured below and within the infiltration zone.

In the study reported earlier it was found that the soil layer wet by infiltration could be divided into three parts, viz., the transmission zone, the wetting zone, and the wet front. The transmission zone occupies the upper part of the wetted soil, and, once established, it absorbs no additional moisture, serving only to conduct water from the soil surface to the wetting zone beneath. Its average moisture content represents approximately 80% pore-space saturation and its average pressure potential is \(-3 \times 10^4\) ergs/gram. As water penetrates into the soil the transmission zone lengths. Calculations based upon water entry rates, pressure potentials measured at the top and base of this zone, and thickness of the zone have shown that its average permeability remains practically constant. The decrease in water entry rate with time is directly proportional to the decrease in average total potential gradient within this zone.

The wetting zone joins the transmission zone to the wet front, and moisture within it increases as infiltration proceeds. In this zone moisture content decreases and pressure potential gradient increases with depth. The wet front is an irregular surface in soils initially air-dry. It is sharply defined by a color change, and by the very high pressure potential drop between the moist soil above and dry soil below. The moisture content of the soil immediately above the wet front plane has been found to be constant, for a given soil, at all depths of water penetration studied. It has been suggested that this moisture content represents the condition of minimum significant capillary permeability.

It was concluded from these earlier measurements that the moisture potential and permeability conditions within the soil may be used to explain observed phenomena associated with water entry, often-observed influences upon infiltration of raindrop impact upon the soil surface, inwashing of overland flow, and compression of air ahead of the wet front, which were purposely excluded or minimized in the study, are considered simply to modify the results without altering the basic relationship between infiltration rate and soil moisture conditions. The present study was undertaken to determine whether the explanations advanced for water infiltration into dry uniform soil may also be applied also to infiltration under other initial conditions.

### INFILTRATION INTO MOIST SOIL COLUMN OF UNIFORM TEXTURE

This study was conducted with the sandy loam and silt loam packed in clear celluloid cylinders 2 inches in diameter and 3 feet long. Two cylinders of each soil were prepared by treatment consisting of irrigating the soil from above until water had penetrated 44 cm deep, moving the surface water and capping the soil to prevent evaporation during the subsequent 5-day drainage period. At the end of the drainage period water penetrated 75 cm deep in the sandy loam and 54 cm in the silt loam, the individuals of each pair showing close agreement. Dry soil was still present below the drainage wet front. This study was conducted with the sandy loam and silt loam columns, respectively. It will be noted, however, that moisture varied considerably with position in the soil columns as well as in indicating energy conditions at the end of the drainage period. Tensiometer measurements were made at depths of 2, 5, 10, 15, 20, 25, 30, and 35 cm in the unsampled column of each pair during the course of irrigation. These tensiometers were intended for use in determining the penetration of infiltrating water in the drained soil columns as well as in indicating energy conditions of the drainage period. The tensiometers were 2-mm bore capillary manometers in fired-clay tubes ½ inch in diameter and 1½ inches long, to offer minimum interference to water movement. The tensiometer and silt loam, and with 2-mm bore capillary manometers to provide prompt response to pressure potential changes of the soil. Duplicate columns showed close agreement as to offer minimum interference to water movement, indicating that interference to water flow had been minimal.

Soil moisture and pressure potential (\(\psi\)) within the drained soil columns are shown in Fig. 1. The greatest part of each column was saturated under these conditions, equivalent, averaging 18 and 20% in the sandy loam and silt loam columns, respectively. It will be noted, however, that moisture varied considerably within the given soil, at all depths of water penetration.