A SIMPLIFIED APPARATUS FOR THE MAINTENANCE OF CONSTANT WATER HEAD FOR HYDRAULIC CONDUCTIVITY MEASUREMENTS

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ABSTRACT
A simple apparatus is designed for maintaining the water head constant during the hydraulic conductivity measurements of the saturated soil columns. The apparatus is based on the Mariotte flask of Klute (1965). The newly designed apparatus can be made easily with less cost in almost all the laboratories. The new design offers two benefits i.e., 1) less cost of preparation 2) Refilling is possible in a few minutes, leaving the whole system effectively in operation.

INTRODUCTION
The lack of sufficient water supply for irrigation in a arid and semi-arid zones necessitates the use of water with a relatively high sodium content. It is generally recognized that the concentration of sodium and other cations in irrigation water can affect the permeability of soils greatly by dispersion (Quirk and Schofield, 1955: Felhendler et al., 1974: Frenkel et al., 1978 and Shainberg, et al., 1981 a&b) and swelling (Norrish, 1954; Norrish and Quirk, 1954; McNeal et al., 198 and Van Olphan, 1977) of soil clays. The most common measure of the effect of sodicity/ salinity on soil permeability is the determination of relative hydraulic conductivity in the laboratory. For hydraulic conductivity measurements a reservoir containing the water/ solution is always required, where the constant water head could be maintained. Complex apparatus is described by various scientists, of which the apparatus described by Klute, (1965) is more often used in various laboratories. A simple apparatus is developed which allow the similar measurements as that of Klute. This apparatus allows the filling of the reservoir without disconnecting the HC measurements.

MATERIALS AND METHODS
The simplified apparatus for maintaining the constant water head is shown in fig. 1 in comparison with that of Klute. The reservoir has two openings. Two holes were made in the bung in the lower opening, the first to allow the transmission of the water/solution to a series of soil columns via a plastic tube, of which HC is to be determined, the second hole to be used to lower the water head to the lower tip of the glass tube by draining the water and hence maintaining the water head. During the leaching operation the tube from this 2nd hole will be kept close by a clamp. The benefit of this opening is that the level of the water/solution in the reservoir can be decreased within a few seconds, leaving the whole system effectively in operation by closing the plastic tube which leads to the soil columns whilst refilling the reservoir and subsequently lowering of the level to its previous position by opening the second outlet.

RESULTS AND DISCUSSIONS
The hydraulic conductivity measurements can be performed in a simple apparatus designed and described above. This enables the water head to be maintained constant and hence allows the measurements of hydraulic conductivity of saturated soil columns in the laboratory. A number of soil columns may be connected to this apparatus provided that there is sufficient capacity in the reservoir to permit the measurements to be made. This apparatus is modified from the Mariotte flask as shown by Klute (1965). Basically, the air at the top of the reservoir is isolated from the atmosphere, as the water solution initially leaves the reservoir via the outflow at the bottom. At this time, air enters into the reservoir through a long glass tube and the air pressure rises with the outflow. The rising air pressure offsets the falling water pressure, resulting in a constant hydraulic pressure regardless of the water level in the reservoir. The hydraulic gradient may be obtained from direct observation of the water levels or by piezometers inserted into the sides of the soil columns. The