FURTHER DEVELOPMENTS ON APPARATUS FOR FIELD MOISTURE STUDIES

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Introduction

Porous ceramic cells may be used in various ways in the field for obtaining information on the condition of moisture in soil. The capillary tensiometer (2) which is a porous cell connected to a vacuum gauge, makes it possible to measure the capillary tension in the soil water over the tension range extending up to about 65 cm. of mercury. Tensiometers will be found useful on such soil and water conservation problems as pertain to the depth, the rate of penetration, and the storage of water in soil. They should also prove useful in following moisture changes in earth dams, in highway subgrades, and in studying the moisture absorbing characteristics of plant root systems. The direction and magnitude of the water-moving force in soil may be determined from tension measurements at several points, thus providing information on the direction of water flow in soil. Since the rate of water flow through soil can not be determined from tensiometers a soil moisture flow gauge was developed. Field trials carried on during the past summer with a flow gauge utilizing porous ceramic cells and a drop counter having the same general principle of operation as that described by Ivie and Richards (1) have given promising results. It is the purpose of this paper to describe some new developments on tensiometers and soil moisture flow gauges and to discuss some of the factors affecting their operation.

Tensiometers

Field experience has led to some new tensiometer designs which are shown in Figure 1. The form shown at A and B was developed to minimize the disturbance from thermal expansion of the tensiometer water. The tapered porous cup having a glazed bayonet top fits on to a length of one-inch thin-walled steel conduit tubing. At D is shown a case hardened steel fixture which simplifies sawing off the tubing and drilling for set screw holes. Two brass filister screws with heads inside the tubing form the lugs to engage the top of the bayonet cup. The third screw, shown, locks the cup in place. The two 1/8-inch copper tubes which serve for filling water and connecting to the vacuum gauge make connection to the cup through a hole rubber stopper. Tube 1 has a file notch at the lower surface of the stopper pinched together at the end while the end of tube 2 is open. Both tubes are coated with DeKhotinsky cement up to above the rubber stopper. Tube 1, between the rubber stoppers, is further insulated with rubber tubing. Both tubes have insulation removed at their extreme lower tips. Radiator air cocks make satisfactory needle valves. The disadvantage of not having a stuffing box around the needle may be overcome by arranging a piece of rubber tubing as shown at 3. If the porous tube is to be used with a vacuum recording gauge cock 4, Figure 1B, is mounted on the gauge. With the arrangement shown it is apparent that measuring the electrical resistance between tubes 1 and 2 will give an indication of the amount of air in the cup. A small direct-reading radio ohmmeter may be used for this purpose. To fill the unit, boiled water is admitted through cock 4 until all the air is expelled through cock 5. When the level of the water in the cup reaches the lower end of tube 1 the resistance reading drops to about five or ten per cent of its former value. 

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