

NOTE

NEW PIEZOMETER HAMMER AND JACK FOR EASY INSTALLATION AND PULLING OUT OF THE PIEZOMETER IN DRAINAGE AND GROUND WATER STUDIES

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Abstract — In drainage and ground-water investigations piezometer has been installed by regular hammering, by jetting down with compressed water, or by using a modified hammer which has a handle at one end and a leading pipe at the other. Each of the above methods has some disadvantages.

The new piezometer hammer and jack described here consists of a hammer, a holder which provides a base for hammering and a jack which pulls out the piezometer for detaching the marble or saving the piezometer.

With the new piezometer hammer and jack there is no need for a ladder in installing a long piezometer. It would not cause the piezometer to bend or crush at one end. The installation is easy and quick. There would be no need for a long steel bar to push the marble or the pivot away from the end of the piezometer. The piezometer can be easily pulled out without being bent or damaged.

INTRODUCTION

The piezometer is an important tool which is used extensively in drainage and ground-water studies [2, 3]. It is used mainly for determining depth of a water table and its fluctuations, the presence of artesian aquifers and extension and kinds of soil layers in artesian areas, and the hydraulic parameters of aquifers [5, 6].

Since the piezometer has so many applications and almost everyone concerned with the investigation of drainage, ground-water, and irrigation deals with it, the development of an easy method for its installation and handling would be very useful. The placing of a piezometer, especially in heavy clay soils, is very difficult and requires much energy and time. In this paper a device is described for easy installation and handling of piezometer.

In the past, regular hammer, water jetting and modified hammer methods have been applied for installing piezometer in the soil. Regular hammer is not too practical because the piezometer cannot be installed too deep, and also long pipes will often bend due to eccentric hammering. Water jetting is a good method, but is not always applicable because it requires a tank of high pressure water which is, in general, rather difficult to provide and handle. The modified hammer has a handle at one end and a leading pipe at the other. This is a good device, but when it is desired to install a long piezometer, a

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ladder is needed which can be very inconvenient. Besides, the piezometer might buckle during the hammering [1, 4].

MATERIALS

The various parts of new hammer and jack are shown in Fig. 1. It consists of a hammer, a holder and a jack. The hammer is used to hammer down the piezometer (Fig. 1b) and consists of a solid cylinder with two upper and lower sections of different diameters. The upper section is used as a handle with an optical density (O.D.) of 4.5 cm, and the lower part is heavy with O.D. of 9 cm. The inside diameter of the hammer is 3 cm. This makes the hammer slide easily around the piezometer.

The holder is used to hold the piezometer tight during the hammering and consists of a cylinder with 10.5 cm height, 9 cm O.D. and 2.2 cm I.D. (Fig. 1a). This cylinder is cut in two halves and can be fastened together with four bolts (Fig. 1a). The inside of the holder is threaded in order to give a better grip to the piezometer.

The jack is used to pull out the piezometer (Fig. 1c). It consists of a ring cut in two pieces with a handle attached to each piece. The two parts are connected together by two

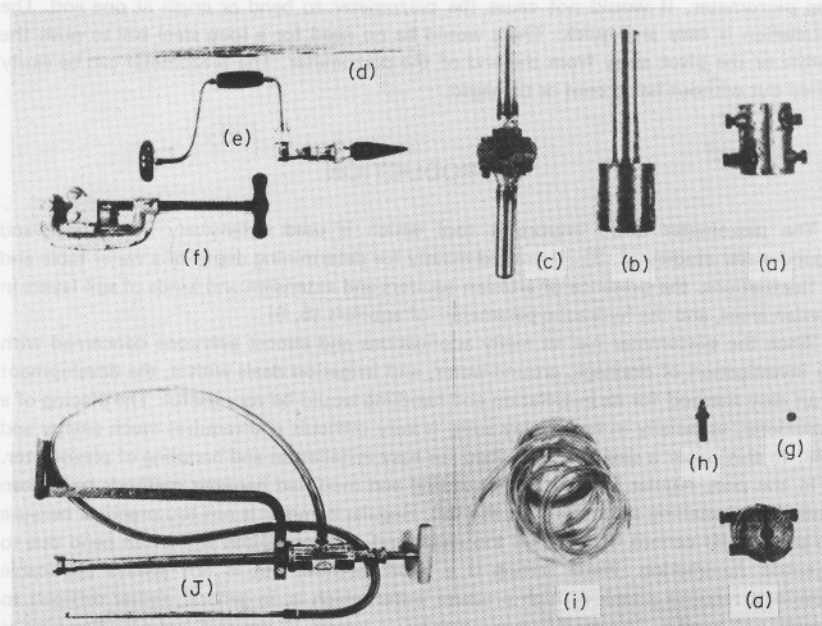


Fig. 1. The piezometer tools; (a) the holder, (b) the hammer, (c) the jack, (d) the piezometer, (e) the rimmer, (f) the cutter, (g) the marble, (h) the rivet, (i) the tubing and (j) the flushing pump.

bolts. The inside of the ring is threaded to hold the piezometer tight when the jack is used to pull out the piezometer. In medium textured agricultural soils with depths of 2-6 m two men can easily pull out the piezometer with no damage to the jack. The hammer and jack are made of tempered steel.

METHOD

The piezometer (Fig. 1d) is cut (Fig. 1f) to the desired length and the cut end is rimmed (Fig. 2e). While the piezometer is laid on the ground the holder is fastened to a desired length and the piezometer is protruded into the hammer hole. Then, the piezometer is held vertically with a marble (Fig. 1g) or a rivet (Fig. 1h) at its end to prevent the soil from entering it. After assuring that the piezometer is held vertically, the hammering starts. When the holder reaches the ground surface, it has to be placed at a proper elevation by loosening the bolts and pulling it up and tightening the bolts again. This action continues until the piezometer reaches the desired depth.

To get rid of the marble which had been placed at the bottom of the piezometer, the piezometer is pulled up about 10 cm with the jack (Fig. 1c). To loosen the 10 cm of soil at the bottom of the piezometer, the soil is flushed with a flushing pump (Fig. 1j) until clear water comes out from the piezometer. When the water level in the piezometer is in equilibrium with the water table, the depth of water in the piezometer is easily determined by blowing through a tube sent into the piezometer (Fig. 1i).

After the study is done the piezometer can easily be pulled out undamaged from the medium textured soil at depths of 2-6 m.

The new piezometer hammer and jack have the following advantages. When the piezometer is long, hammering is very easy and there is no need for a ladder. The piezometer will not bend or crush at one end as often happens in other methods. The installation is quick and easy. There is no need for a long steel bar for pushing the marble or the rivet away from the end of the piezometer and the piezometer can be easily pulled out without being damaged or bent.

Like all equipment, this apparatus has its own limitations as follows. In very heavy soils, the thread and the bolts of the holder should be very strong in order not to slide down during hammering. When the piezometer is installed rather deep (deeper than 6 m, depending on the type of soil) more than two people are needed to pull it out.

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