testing operation the sample is surrounded by the brass-ring.

The micrometer screw at the top of the apparatus is adjusted, the cone with its weight released and the penetration measured by the screw.

The test is made with different weights on the cone and several readings for each weight.

By comparing the results obtained by this cone-apparatus with those ob-

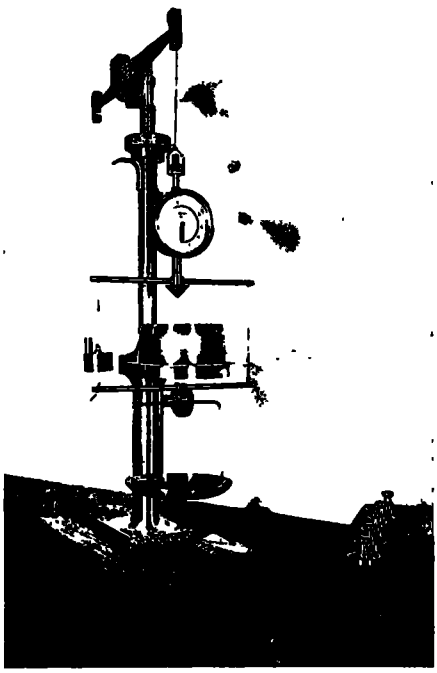

Figure 78. Cone Test Device. Huizinga

tained by the Godskesen's spring-scale cone, shown in Figure 72, (where gradually increasing weight is applied), it was found that the ratio of the values obtained by the two methods varies somewhat according to the firmness of the clay.

T. K. Huizinga: The top angle of the cone in the apparatus illustrated in Figure 78 is 90°. The penetration is measured with a micrometer dial.

The test starts with the cone touching the surface of the sample. Then it is loaded every two minutes with equal loads. Penetration is measured two minutes after each loading.

PENETRATION DEVICES—BEARING

T. E. Stanton, Jr.: For use in the bearing value test the material is wetted to optimum moisture content and compacted in a 6-in. cylinder under 2000 lb. per sq. in. pressure. The sample is then tested for bearing value (Fig. 73) by penetrating the center of the sample 0.05 in. per min. with a piston, 3 sq. in. in area. The loads for each 0.1 in. increment of penetration are recorded to a total of 0.5 in. The bearing value is also determined on the sample after soaking and swelling.

Dr. A. Casagrande: In connection with a study of the extent and degree of disturbance in so-called undisturbed samples, Dr. M. J. Hvorslev developed at the Harvard Soil Mechanics Laboratory a new type of loading apparatus by means of which unconfined cylinder compression tests on very small samples can be made as well as various types of surface loading and cone penetration tests. The fact that this apparatus can be used with equal ease for any one of these tests and that it is very compact and readily portable should make it a useful aid in both research and field laboratories.

Figure 79 shows the apparatus set up for an unconfined compression test on a small clay prism.

The apparatus consists of a base (A) with a pipe standard (B) on which the adjustable bracket (C) slides. The bracket holds the tube (D) which guides the piston tube (E). Inside this tube is a piston rod terminating in the piston (F); approximately at the center of the rod is a thrust collar against which two calibrated springs of equal size act. The two springs are under initial compression and the whole system is thereby

counterbalanced in any position. The piston tube can be moved up or down by means of the loading screw (G) and a double acting thrust ball bearing. When the piston tube is forced down against the test specimen the upper spring will be further compressed and the downward force against the thrust collar increased, while the lower spring is released and the upward force against

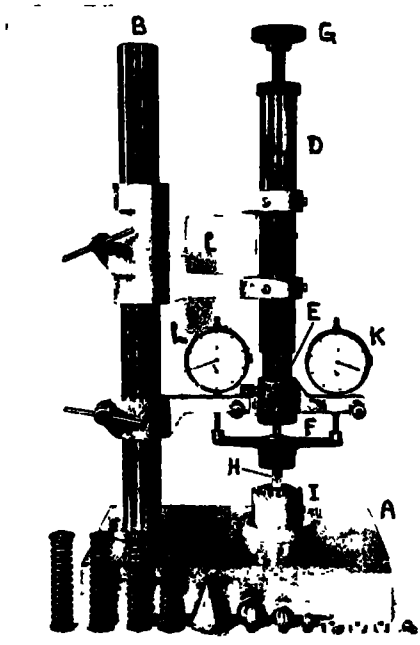

Figure 79. Apparatus for Unconfined Compression and Penetration Tests. Casagrande.

the thrust collar decreased. As the total force is being produced by simultaneous compression of one spring and release of another spring, the hysteresis effects in the springs are counteracted to a large extent. The test specimen (H) is protected against evaporation by a "Lucite" tube which dips into an annular water basin in the pedestal (I). The dial (K) measures the movement of the springs and thereby the force exerted; the dial (L) measures the deflection of the test specimen or the penetration of the piston.

In front of the apparatus are shown an auxiliary cone, and spherical and cylindrical pistons of various diameters. The pistons are readily attached to the main piston after the lower part of this piston has been unscrewed. The apparatus is furnished with three sets of easily exchangeable springs by means of which maximum loads of 2.5 kg., 11.5 kg., and 25 kg., can be exerted. These loads correspond to a total movement of 1.0 cm., and each division on the dials indicates, therefore, a load increment of 2.5 g., 11.5 g., and 25.0 g., respectively. The apparatus can be used for unconfined compression tests on specimens varying from 1.0 cm. to 3.5 cm. in diameter. In comparison with the standard Swedish apparatus for cone penetration tests, the apparatus shown has the advantage that the impact of the falling cone piston is avoided and that the force corresponding to 1.0 cm. penetration is measured directly; furthermore, if desired the complete curve giving the relationship between force and penetration can easily be obtained.

Prof. W. S. Housel: Use is made of the hydraulic plasticity needle in setting up a small bearing capacity machine by adding a frame and loading arrangement.

EXTRUSION DEVICES

Prof. D. M. Burmister: The simplified squeeze test, shown in Figure 76A, is used for soft to medium-stiff plastic clays to determine the amount of disturbance of so-called undisturbed samples. A sample with an end area of 2 sq. cm. and 1 cm. high is cut with the small core tube, placed in the holder, pushed out by the plunger, and the whole set over the base leaving the sample laterally unconfined. Pressure is applied by deflecting the calibrated leaf springs