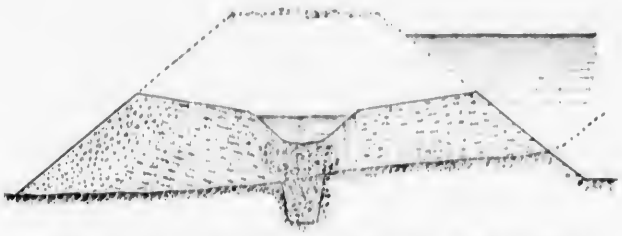

The mode of compacting reservoir embankments, almost universally followed by American engineers, is to specify that the earth shall be spread evenly over the surface in layers of from 4 to 6 inches in depth, then moistened and rolled with grooved rollers weighing from 100 to 300 lbs. per inch of tread. In most instances the number of times each layer is rolled is left to the decision of the engineer, but some specify a minimum roller travel in miles for each 1000 cubic yards excavated.

Opinions differ as to the amount of water to use. In gravel puddle, or what the writer has termed, clay concrete, in which the percentage of clay is small, a large amount of water can be used with good results. This mixture unquestionably makes the safest embankment.

To those who persist in using chiefly clay, it may be said that the addition of water to moisten the layers is of doubtful benefit. The effect of water on comparatively dry clay is to increase its bulk, and no amount of rolling will make it quite so compact as it would be if rolled to the same extent in a dry state.

In reference to compacting materials by depositing them under water, as was done on the Ogden reservoir, by means of a canal in the center, the reader will note that this method is applicable only to gravel puddle or clay concrete containing less than 25 per cent. clay. A higher percentage of clay would render the embankment so soft that it could not be traversed by teams, but the method is particularly well adapted to earth containing either no clay or very little.

In so far as the author knows, this method has never been tried before. If the reader, however, compares tests No. 1c, No. 2c, No. 3c, and No. 4c, with corresponding tests (*b*) and (*a*), he will find that, when the percentage of clay is small, as compact a mass can be made by simply pouring the earth into water and mixing as by moistening with water and thoroughly ramming.

It is, however, from practical experience rather than from the few preceding experimental tests, that the writer bases the following conclusions:

1. Earth deposited under water is freed from the greater part of the air confined in the open space.

2. Earth containing grains of different sizes packs better under water than in air.

3. Embankments built of dry earth, or earth moistened and packed, are more liable to be injuriously affected by capillary action than embankments, or portions of embankments, built under water.

4. Making provision during construction for a canal holding water in the center of the embankment, is a practical test, before completion, of the safety of the structure.

5. Most of the advantages of a center core are gained by this mode of construction without the disadvantage of having distinct lines of separation between an earth and a masonry wall.

6. Where water is abundant and easily applied, the middle portion of earth dams can be more cheaply compacted under water than by sprinkling and rolling.

THE DIMENSIONS OF RESERVOIR EMBANKMENTS.

The proper widths and slopes to adopt in the building of earthen dams cannot as yet be determined by mathematical calculations. Our knowledge of soil physics is too meager to admit of limiting the