trickling all along the trench, the other from one definite point which it was found possible to isolate. The total amount measured in the trench was 140 gal, 110 of which came from the isolated point. The remaining 30 gal constituted the total percolations under the dam and corresponded with the 16 gal computed. The difference is still important; it has to be realised, however, that we certainly have neglected another permeable zone beside that which we had detected. It may therefore be safely assumed that this method gives a figure representing a degree of approximation sufficient for the present purpose.

No. K-4 THE LAW OF DISTRIBUTION OF MOISTURE IN SOILS AND METHODS FOR THE STUDY OF THE SAME

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The distribution of moisture in soils from concentrated sources of moisture, is contributed by:

1) Capillary force.
2) The weight of the water.
3) Its pressure.
4) The initial moisture of the soil.
5) The resistance of the soil to motion of the moisture contained within.
6) The evaporation of the moisture inside the soil, on the surfaces of the borders of the moistured zone.

The law of the distribution of moisture, under the action of capillarity alone, can be expressed by the heat transmission equation of Fourrier.

$$K^2\left(\frac{\partial^2\theta}{\partial x^2} + \frac{\partial^2\theta}{\partial y^2} + \frac{\partial^2\theta}{\partial z^2}\right) = \frac{\partial\theta}{\partial t} \quad (1)$$

where K^2 = coefficient of moisture penetration.
θ = moisture of the soil.
x,y,z = coordinates of the points under investigation.
t = time.

An investigation into this relation was carried out under one dimensional phenomena which may be expressed by the following equation:

$$K^2\frac{\partial^2\theta}{\partial x^2} = \frac{\partial\theta}{\partial t} \quad (2)$$

by means of continuous moistening of the soil in glass tubes, without the application of pressure.

In that case the solution of equation (2) appears as follows:

$$\theta = \theta_o + \frac{2(\theta_a - \theta_o)}{\sqrt{\pi}}\int_{\eta}^{\eta = \frac{x}{2K\sqrt{t}}} e^{-\eta^2}d\eta \quad (3)$$

$$Q_{x=0} = -\frac{2\lambda(\theta_o - \theta_o)}{K\sqrt{\pi}}\cdot\sqrt{t} \quad (4)$$

where θ_a = the initial moisture of the soil;
θ = the value of the moisture, corresponding to the coordinate x;
t = time elapsed since the beginning of the application of moisture.
$Q_{x=0}$ = quantity of water, that reached the soil through the permeable area. (x = 0)

In the experiments that were carried out only the value of x corresponding to the sharply marked border of the moistened zone at every moment of observation, was determined; in that way character of arbitrariness was avoided.

At this border the moisture of the soil can be considered as constant - in relation to the constancy of its initial moistness (air dry condition).

In this case the expression may be expressed thus:

$$\theta = \theta_1 = const = \theta_o + \frac{2(\theta_a - \theta_o)}{\sqrt{\pi}}\int^{\frac{x}{2K\sqrt{\pi}}} e^{-\eta^2}d\eta$$

or

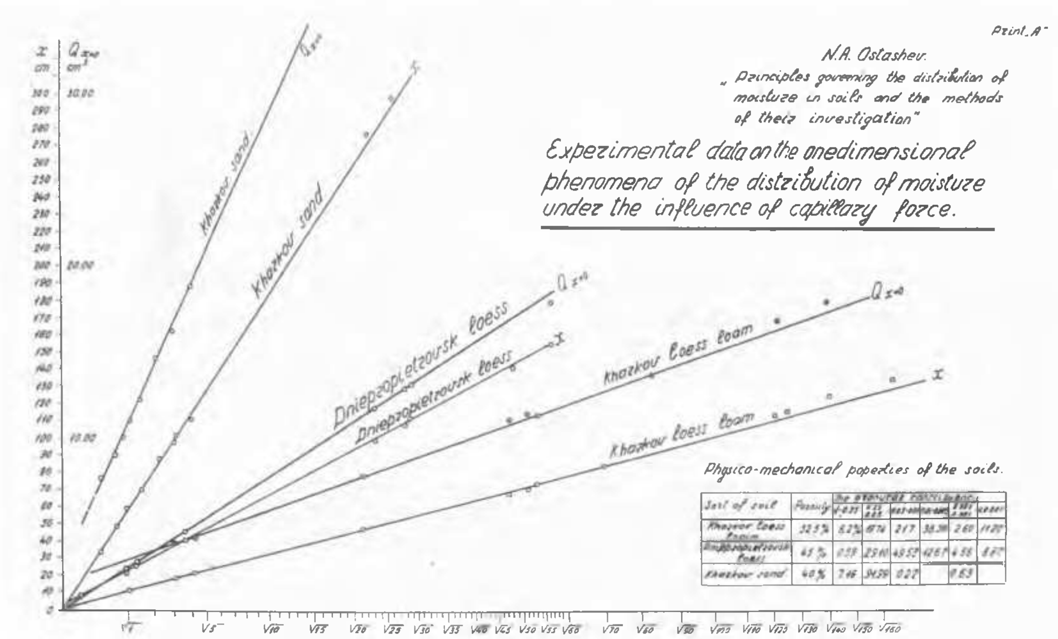
$$\frac{(\theta_o - \theta_1)\sqrt{\pi}}{2(\theta_o - \theta_a)} = const = \int^{\frac{x}{2K\sqrt{t}}} e^{-\eta^2}d\eta$$

whence

$$\frac{x}{K\sqrt{t}} = const = A, \quad x = B\sqrt{t}$$

(See A. Schak, "Heat transmission in industrial plants". Energy publishing, 1933, page 39-40. Dept. of research publications.) i.e. the coordinates to the points of constant moisture (in this case the coordinates of the borders of the mentioned zone) are proportional to the square root of the time.

The same expression also holds true for $Q_x = 0$. Experiments with sand and loess have fully confirmed the laws herein enunciated, as may be seen from the following experimental data:



On the participation of the force from the weight of the water the process of distribution of the moisture in soils may be considered, as a distribution of some hypothetic "weighty" heat, where moisture plays the part of temperature.