UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Translation No. 31

NEW DENSIMETER FOR THE RAPID MEASUREMENT OF THE DENSITY OF SOLID BODIES

by

Anonymous

Translated by Mrs. Séverine Britt

Washington
1951

NEW DENSIMETER FOR THE RAPID MEASUREMENT OF THE DENSITY OF SOLID BODIES
(A translation)

ANONYMOUS - Nouveau densimètre pour la mesure rapide de la densité des corps solides; Le Génie Civil, No. 23, Paris, December 1, 1947.

Translated by Mrs. Séverine Britt, U. S. Geological Survey, June 1948.

The density of a rock is a constant which may be used in the determination of the nature of the rock; a method of rapid measurement of density may be of great value to prospectors. Easy field determination of density can be made with a new densimeter, described by Mr. J. Goguel in the review "Mesures" of May 1947.

The instrument, as shown on fig. 1, includes a graduated arc "a", freely suspended in a ring which may be held by hand. The graduations indicate density from 1 to 20, with an adjusting mark "oo". A beam "b" of special shape pivots on the center of the arc. A pointer at the end of the beam moves in front of the graduated arc, and a short arm "c" contains the suspension axis for the sample; extending from the beam a lever "d" along which a movable counterweight "e", fixed by a tightening screw, may slide; a second and lighter counterweight "f" may be used for adjustment along the threaded end of the lever "d".

The procedure for use of the instrument includes the following operations:

1) Hang a sample of 130 gr to 360 gr on the loop of the steel wire suspended from the arm "c".

2) By use of counterweight "e" balance the beam so that the pointer is on the adjusting mark "∞"; fine adjustment may be made with the small threaded counterweight "f".

3) Dip the suspended sample into pure water. The beam pivots and the pointer indicates the density of the sample.

Before the sample is attached to the instrument, the beam is adjusted so that the center of gravity is at the axis of rotation. When the sample is attached, the center of gravity of the mass is displaced and the counterweights have to be displaced so that the center of gravity of the beam is, for instance, at G (fig. 2). "M" being the mass of the suspended sample of density "D", and "m" the mass of the beam, the equilibrium of the latter corresponds to the following equation:

$$M.g.OS.\cos\alpha = m.g.OG.\cos\beta \qquad \text{(Equation 1)}$$

When the sample is dipped in water, it is subjected to an upward pressure equal to the weight of the displaced water; this reduces its apparent weight to:

$$M\frac{D-1}{D}g.$$

To re-establish the equilibrium, the beam turns through an angle "x" so that:

$$M.\frac{D-1}{D}g.OS.\cos(\alpha - x) = m.g.OG.\cos(\beta - x)$$

(Equation 2)

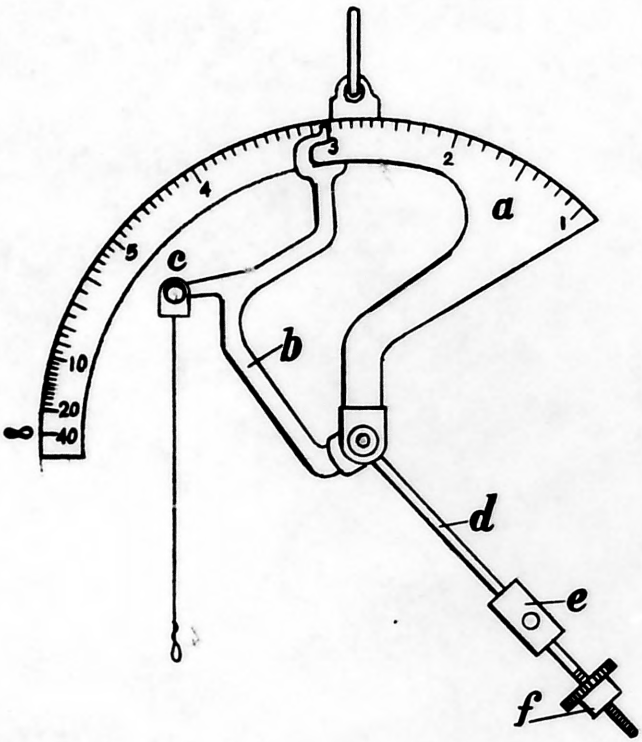
Dividing equation (2) by equation (1):

$$\frac{D - 1}{D} \cdot \frac{\cos(\alpha - x)}{\cos \alpha} = \frac{\cos(\beta - x)}{\cos \beta}$$

from which:

$$\cot x = \tan\alpha + D(\tan\beta - \tan\alpha) \quad \text{(Equation 3)}$$

This equation shows that the new position of balance depends only upon the density of the sample and not upon its mass. The arc is therefore graduated to give the density directly.



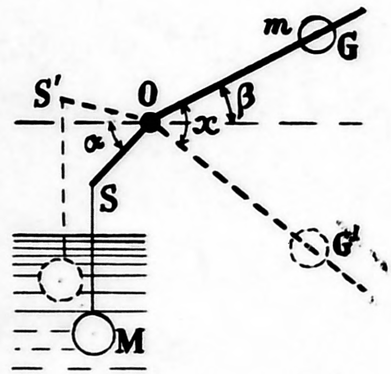


Fig 1. Diagram of Densimeter

Fig 2. Diagram showing operation