

would appear from this that such distinguished personages as Columbus, da Vinci and Copernicus were born twice! But, what is far worse, that such benefactors as Peter the Great, Hans Sloan and Galileo Galilei suffered a double death! It used to be said that "oil and water will not mix," but we entomologists now know very well that there is such a thing as a miscible oil. However, history and fiction are alleged to be utterly incompatible—I wonder? Seriously speaking, this chronological table will be of great service to students of entomological history.

This is a well-built book. It is bound in keratol, printed on thin, calendered paper, and although it is but little more than one and one half inches thick, it weighs about three pounds!

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## SCIENTIFIC APPARATUS AND LABORATORY METHODS

### THE SHAPOMETER: A DEVICE FOR MEASURING THE SHAPES OF PEBBLES

FOR several years the senior author has been interested in methods used for calibrating the shapes of pebbles, and he has been working on a method which could be used by a number of workers and yield comparable results. In a paper published recently<sup>1</sup> he described a method which has been tested during the last two years by a number of students in connection with their research problems. The validity of the method became apparent not only for grains of sand size but also for pebbles, cobbles and small boulders. A method by which the shapes of sand grains may be measured by using a petrographic or binocular microscope was suggested in the paper just cited, and the statement was made that the instrument to be used in measuring pebbles and cobbles would be described later. The instrument is called a "shapometer." The general idea of the shapometer was suggested to the junior author who perfected it and measured several hundred pebbles to prove the utility of the instrument.

According to the method proposed by Tester,<sup>2</sup> the shape of any pebble measured is the ratio of abrasion to the original angularity, and measurements are made of the remnant sides or edges and of the projected original edges. Hence, a simple instrument with three or four straight edges calibrated in small units and with movable slides or pivots will suffice for measurement. Fig. 1 is a generalized

<sup>1</sup> A. C. Tester. "The Measurement of the Shapes of Rock Particles," *Jour. Sed. Petrol.*, Vol. 1, No. 1, 1931.

<sup>2</sup> *Op. cit.*

sketch of the shapometer with 1 mm divisions on the main parts. The lower member "A" is graduated and slotted as shown, to permit an easy sliding of scale 'C.' Scale 'B' is attached to 'A' by a fixed

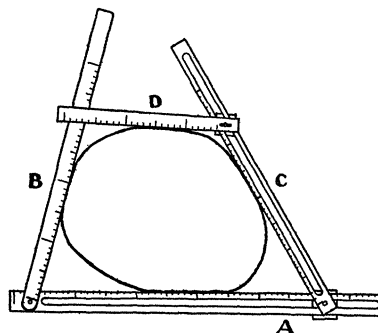


FIG. 1

pivot and although it will not slide it will make with "A" any angle desired. Scales 'B,' and 'D' are graduated in the same units as 'A.' Experience shows a millimeter scale to be satisfactory. Scale 'B' is solid, but 'C' is slotted to permit the attachment of a fourth scale 'D.' Scale 'D' is provided with a screw so it can be removed, but it is very useful when measuring a section of a pebble which has four or more principal surfaces.

The instrument may be constructed of stiff cardboard, celluloid or light weight metal. The writers have used the common 6 inch celluloid millimeter scales with considerable success, but aluminum bars are ideal. The scale 'A' is 7 inches long over-all length.

TABLE I

Surface or side measured	A	B	C	D
Projected lengths or original edge.....	44	28	31	22
Length of remnant edge.....	14	9	10	8
Ratio of remnant to original edge (angularity ratio).....	$\frac{14}{44}$ 31.8%	$\frac{9}{28}$ 32.1%	$\frac{10}{31}$ 32.2%	$\frac{8}{22}$ 36.3%
Ratio of abraded to original edge (abrasion ratio).....	$\frac{30}{44}$ 68.2%	$\frac{19}{28}$ 67.9%	$\frac{21}{31}$ 67.8%	$\frac{14}{22}$ 63.7%
Average abrasion ratio or roundness = 66.9%.				

The use of the shapometer is illustrated best by a study of Fig. 1 in which a pebble is shown in one of the three principal positions. The graduations on the scale are in millimeters. The following table shows the nature of the readings.

The junior writer has found that a smaller shapometer with a range of 75 mm instead of 150 mm is advantageous for measuring particles below 40 mm. The greater ease of handling the smaller instrument insures more accurate and rapid results.

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#### APPARATUS TO CIRCULATE LIQUID UNDER CONSTANT PRESSURE IN A CLOSED SYSTEM

THIS apparatus is designed to circulate a liquid and to maintain a constant pressure in a sterile system, without the use of joints or moving parts in contact with the circulating liquid.

The apparatus is a single piece of glass. Pressure is maintained by the head of liquid and the liquid is raised and kept in circulation by placing the apparatus on a tilted base which is given a circular motion without being permitted to rotate. This motion carries the liquid up the coil and into the top reservoir. Gases can be introduced through the tube half way up the coil, and an internal pressure can be main-

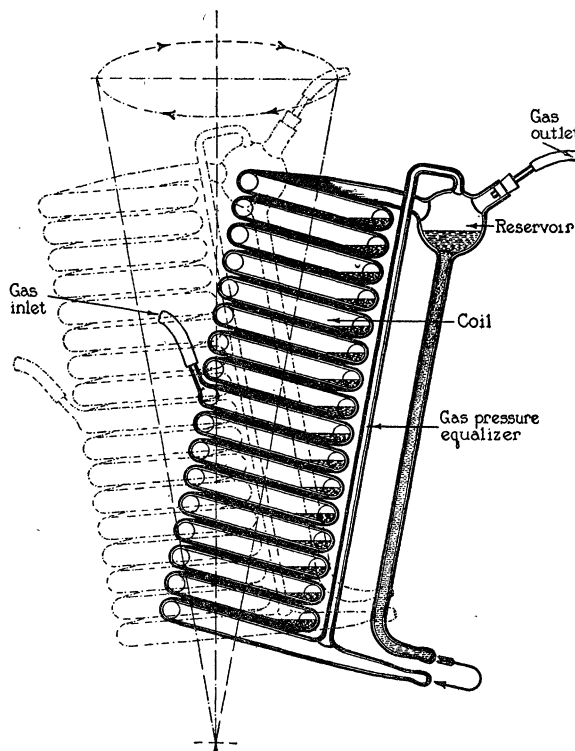


Diagram to show basic principles of apparatus.

tained, if desired, by the displacement of water or other fluid by the exhaust gases.

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## SPECIAL ARTICLES

### GROWTH OF PLANTS UNDER CONTINUOUS LIGHT

STUDIES carried on by the writer since 1926 with plants illuminated both day and night seem of sufficient interest to report upon briefly at this time. Others who have tried somewhat similar although not exactly the same experiments<sup>1</sup> seem not to have secured just the results which have been so apparent in my work. Preliminary accounts of my studies were made at meetings of the Southwestern Division of the American Association for the Advancement of Science in Santa Fe, 1927, and in Flagstaff, 1928. The experiments are being continued, and a full account will be published at a later time.

Plants, chiefly annuals, have been grown in the greenhouse under natural light in the daytime and, in addition, during both day and night they have had the light of two 100-watt Mazda lamps suspended above the bench at a distance of four feet—the lamps provided with an overhead reflector. Controls,

shielded from the artificial light, are growing in the same room of the greenhouse on the same bench at a distance of about ten feet. A total of nearly one hundred species have been worked with, some of them during two or more seasons if first results seemed doubtful. The list includes common garden vegetables, grains, weeds, native herbs and garden ornamentals.

In general, the experimental plants are taller than the controls at all times during the entire growth period, this increased height being due to elongation of internodes. Frequently the experimental plants are slender-stemmed and have a decumbent habit. Flowering is usually hastened under continuous light but in a few species is completely inhibited. Plants of some species reach full adult stature, come to blossom, and produce fruit and seed while the check plants are still in the rosette stage close to the ground.

The root system in plants of the experimental series is invariably less extensive than that of the controls; roots are smaller, shorter, and have fewer branches. Thickened taproots do not develop.

<sup>1</sup> J. Adams, *Amer. Jour. Bot.*, 12: 398, 1925. R. B. Harvey, *Bot. Gaz.*, 74: 447, 1922.