SCIENTIFIC APPARATUS AND LABORATORY METHODS

A PHOTO-ELECTRIC COLORIMETER

THE principle of this simple apparatus is the following: In a blackened, covered wooden box a small rectangular glass jar (Fig. 1: 3), containing the fluid to be tested, is placed between an electric bulb (15 watts) (Fig. 1: 1) and a photoelectric exposure-meter

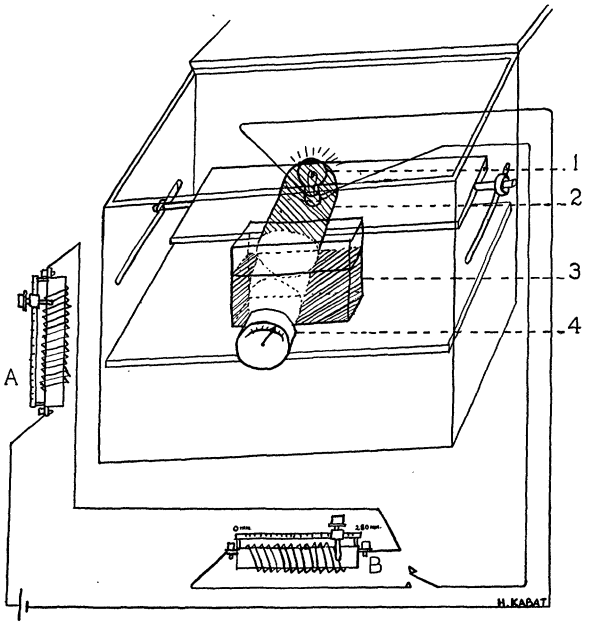

FIG. 1.

(metrophot or other devices) (Fig. 1: 4). A blackened metal tube (Fig. 1: 2) is mounted together with the bulb on a wooden board, which can be moved forward and backward in order to be adapted to the thickness of different jars. The electric bulb is lightened by the house-current (110 volts d. c.), which is led through two rheostats, the one, A, of 50 ohms and 5 amperes, the second, B, of 345 ohms and 1.1 amp. The current is interrupted by a switch. The slider-rod of rheostat B is subdivided into millimeters. If the current is closed, the light will operate the exposure-meter and the pointer will move to the right, the more, the darker the solution to be tested. Next, the slider of rheostat B is moved until the pointer of the exposure-meter reaches a given point (*e.g.*, 3). The distance in millimeters between the right edge of the slider and the zero point of the slider-rod scale corresponds to a given concentration of the color to be tested and which is found on a prepared table.

To give an example for the calibration of such a table, the determination of phosphorus with the help of the Fiske and Subarrow's method will be described for concentrations of 0.80 mg to 0.40 mg phosphorus per 100 cc. After removal of the glass jar, the slider B is moved to zero, and the slider of rheostat A is adjusted until the pointer of the meter reaches a middle position (*e.g.*, 15). Before each use the apparatus is adjusted to this fixed point, thus compensating the variations of the house-current. Next the glass jar is filled with a solution of mono-potassium phosphate to which the reagents of the test had been added and which contains 0.80 mg P per 100 cc. The cover of the box is closed. Five minutes after the mixture of the different reagents the electric current is shut, the slider of rheostat B is moved to the right outer end (280 mm), and the position of the meter pointer is noticed (*e.g.*, 3). Next, the solution is replaced by one containing 0.75 mg P per 100 cc, and the slider of rheostat B is moved until the meter-pointer again reaches the position of the first test (3). Then the millimeter distance between the right edge of the slider and the zero-point of the slider-rod is noticed (*e.g.*, 253 mm). The experiment is repeated at intervals of 0.05 mg P per 100 cc until a concentration of 0.40 mg P has been tested. Next the millimeter distance between each experiment is divided by 5 and thus a table is obtained which gives the comparative values for solutions differing in 0.01 mg P per 100 cc.

In order to test an unknown solution, the phosphorus content of which is between 0.8 and 0.4 mg per 100 cc, it is filled into the glass jar, after rheostat A has been adjusted. The cover is closed and the slider of rheostat B is moved until the meter-pointer reaches 3. The distance of the slider from the zero point of the rod is noticed and compared with the most closely corresponding figure on the prepared table. Immediately the phosphorus content of the solution in mg per 100 cc will be obtained. Tables for other ranges of concentrations may be obtained in a similar way. The measurements of the different parts are: Wooden box, 20 × 23 × 40 cm; glass jar, 27 × 50 × 53 mm (outer measurements); metal tube diameter, 40 mm, length, 45 mm. The price is approximately between $25 and $50, according to the type of exposure-meter which is used.

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A SIMPLE ERGOGRAPH

WE have had occasion to construct and use a simple hand ergograph which may be of interest to others because of the several advantages it offers. It is readily adjustable both as to size of grip and resisting force. Its construction is such as to promote a steady even pull throughout the operating stroke. It has been found more satisfactory for our research than other ergographs. At the same time it is sufficiently