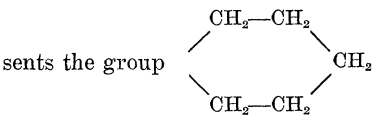
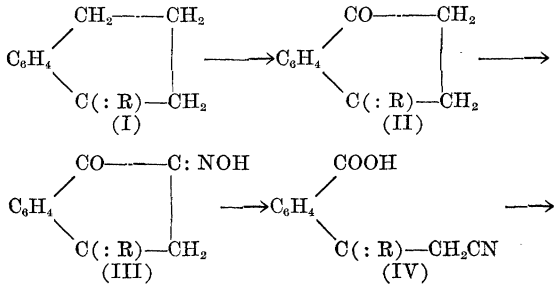
sium nitrate, and the nitro oximes were then hydrolyzed with dilute sulfuric acid. The nitro ketones so obtained were identical and both melted at 192° (corr.). Further, direct nitration of our synthetic spiroketone (VI) gave the same nitro ketone (m.p. 192°, corr.).

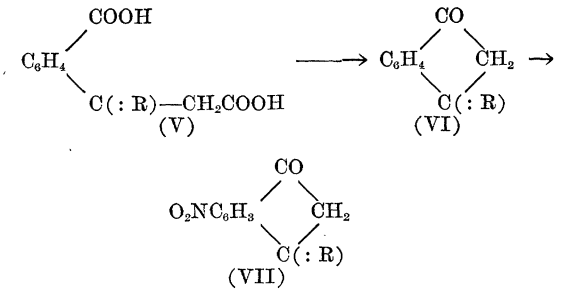
(3) An oxime, m.p. 123–124° (corr.), which yielded a nitro ketone, m.p. 149–150° (corr.). This is evidently the same as the oxime, m.p. 124°, whose nitro ketone melted at 150–150.5°, and which Cook *et al.* suggested was probably the oxime of the *cis*-ketoöctahydrophenanthrene.

The only difference between our operations and those of Cook *et al.* was that our mixture of hydrocarbons was obtained by the action of 85 per cent. sulfuric acid upon the phenylethylcyclohexanol, while theirs was the result either of the action of phosphorus pentoxide upon the cyclohexanol, or of aluminum trichloride upon the corresponding cyclohexene.

The spirocyclohexane-1,1-indanone (VI) was synthesized by the following steps, in which "R" represents the group







The pure spirocyclohexane-1,1-indanone (VI) was obtained as a white crystalline solid, m.p. 58–59° (corr.); oxime, m.p. 137–137.8° (corr.).

All products described in the foregoing gave on analysis figures substantiating the formulas assumed.

SUMMARY

(1) Spirocyclohexane-1,1-indanone (VI) has been found among the oxidation products of the hydrocarbon mixture which results when 1-*beta*-phenylethylcyclohexanol-1 is dehydrated, or when 1-*beta*-phenylethylcyclohexene is cyclized by aluminum trichloride, and its constitution has been proved by synthesis.

(2) Its oxime melts at 137–137.8° (corr.). The oxime of m.p. 187.5°, reported by Cook *et al.* therefore must be derived from some other ketone, perhaps the trans-ketoöctahydrophenanthrene, since we were unable to isolate any oxime of m.p. 177°, the figure which they reported for this compound.

MEYER LEVITZ
DAVID PERLMAN
MARSTON T. BOGERT

LABORATORIES OF ORGANIC CHEMISTRY,
COLUMBIA UNIVERSITY

SCIENTIFIC APPARATUS AND LABORATORY METHODS

AN X-RAY DENSITOMETER FOR MEASURING RELATIVE DENSITIES OF MUSCLE, BONE AND OTHER TISSUES

IN the studies of child growth and development undertaken by the Developmental Health Inquiry of the Associated Foundations it became evident that an objective method for measuring muscle, bone and other tissue densities would be a valuable aid. An x-ray densitometer has been designed and constructed for that purpose and is now in use.

Two other x-ray densitometers have recently been reported, one by P. B. Mack,[1] which is being used at Pennsylvania State College to determine the degree of mineralization of bone in a nutritional study and one by R. G. Bloch,[2] at Chicago University, designed for a study of tuberculous calcifications. Although the apparatus described here is similar in principle to these, its differences are the result of an attempt to obtain an optimum degree of accuracy combined with rapidity of operation and simplicity in interpretation of readings in a unified portable instrument.

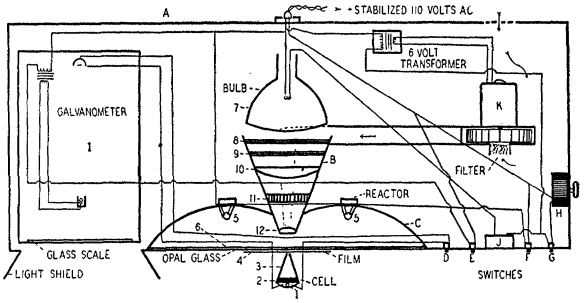


FIG. 1. Top view and circuit diagram.

As shown in Fig. 1, the various components of the

[1] P. B. Mack *et al.*, SCIENCE, 89: 467, 1939.

[2] R. G. Bloch *et al.*, *Am. Jour. of Roentgenol. and Rad. Therapy*, 41: 642–647, 1939.

instrument have been mounted in a special metal case (A) and only 110-volt alternating current is required.

The light source (7) for density measurement is centered in a new type vertical x-ray illuminator (C). Controls (D, E, F, G and H) are grouped on the right-hand panel, and the galvanometer (I) is in the same case to the left. A vertical arm (1) mounting a photo-E.M.F. cell (2) for measuring the light transmitted by any square mm area of film is hinged to turn out of the way while the illuminator is used for other purposes. A brass cone (3) with its interior surface chromium-plated and a 1 mm circular opening at the apex is fitted over the cell. The film (4) is held in place by hinged rubber-tipped arms and can be moved freely to place any desired portion under the cone aperture for density measurement. In the new x-ray illuminator mentioned above, two 18-inch tubular fluorescent bulbs (5) in the special reflector (C) provide a cold blue light for the flashed opal glass (6).

A 150-watt floodlight bulb (7) in the optical system is directed toward the large end of an aluminum cone (B) which contains two glass filters (8, 9), two condensing lenses (10, 12) and a disc of lucite (11), to project an intense spot of cool monochromatic light on the opal glass. A rheostat (H) and voltmeter (J) in the bulb circuit provide a control for intensity of the spot, and a voltage regulator is employed to reduce line voltage variations to $\pm$ 1 per cent. at all values. Heat generated by the bulb in the optical system is dissipated by well-directed streams of filtered air from a rotary fan (K), thus keeping the temperature rise at the film to 9° C. above room temperature under the most intense light. Cell output current is registered on the sensitive portable galvanometer (I) of reflected-beam, enclosed-spotlite type.

A calibration table has been made which permits relative tissue density values, based on absolute film densities, to be noted at a glance for each millimeter of galvanometer deflection. Effects of variations in exposure time, developing and emulsion are suppressed by subtracting the reading for a standard film area from each other reading on that film. The total range of the instrument in units of film density is from 0.3 to 3.0, which includes all the x-ray films in our files.

HUGH E. WEBBER

LABORATORY OF ANATOMY AND
ASSOCIATED FOUNDATIONS,
WESTERN RESERVE UNIVERSITY

METHOD OF EMBALMING LARGE INSECTS[1]

ANY one who has mounted numbers of grasshoppers or other large insects appreciates the difficulties encountered in drying the specimens without deterioration, discoloration or destruction by the larvae of flies.

[1] Contribution No. 205 from the Department of Zoology, University of Oklahoma, Norman.

The following technique was devised by the writer to improve the quality of dried insect specimens by eliminating the difficulties mentioned above. Although the method is original as far as the writer is concerned, others may have suggested similar procedures.

An embalming fluid is prepared as follows:

60 ccs of toluene (or xylene)
25 ccs of tertiary butyl alcohol
15 ccs of ethyl alcohol
5 grams phenol
20 grams paradichlorbenzene
10 drops of balsam in xylene as used in microtechnique

Mix the ingredients in the order named.

The fresh specimen is injected by inserting the needle of a hypodermic syringe in a posterior abdominal segment and running it forward to or into the head, then slowly withdrawing the needle while injecting the fluid. Care should be taken not to force too much fluid into the body cavity at once, as the abdominal segments may be ruptured. After injection, lay the specimen aside a few moments, then pin it in position on a drying board and place in an open place for twenty-four or more hours.

The writer has found that the largest grasshoppers will ordinarily dry in less than forty-eight hours following this treatment. No color changes occur in the injected specimens.

The fluid may also be used as a preservative without injection by merely dropping the specimens into a jar and covering with the liquid. Green-colored grasshoppers bleach somewhat if stored in the fluid. I have other specimens which were stored in the fluid for over a year, then dried, which show very little color change.

Museum pests, mice and flies are effectively repelled by this treatment.

CHARLES CLINTON SMITH

UNIVERSITY OF OKLAHOMA

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