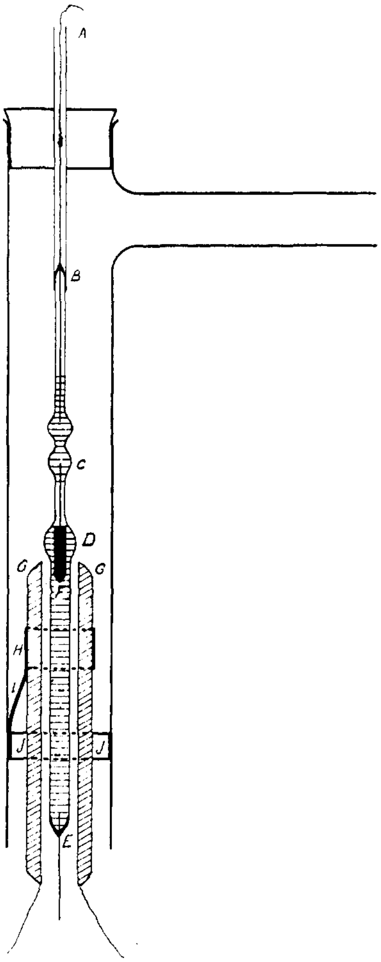
starter, F, consists of an iron plunger (12.7 × 2.38 mm.) fitted with 1-mm. tungsten wire. A solenoid, G, surrounds the lower portion of the lamp and consists of 4 layers of 100 turns each of number 22 enameled, single cotton covered copper wire wound on the barrel of a number 4 cork borer, 9 cm. long. It is held in place and centered in the surrounding water jacket by the device HIJ; H is a brass collar, I is a piece of spring brass soldered to H and to J, and J is a portion of a clock spring expanding against the inner wall of the water jacket. The solenoid is connected in series with a tapping key across a 110 v. a. c. line.



To start the lamp, the cooling water is turned on so that the water jacket is completely and constantly filled with water. The lamp circuit, which is the same as that of Daniels and Heidt, is closed, and the external resistance adjusted so that 10–15 amp. flow through the lamp. The solenoid circuit is then closed momentarily with the tapping key. The resultant magnetic field snaps the starter to the lower portion of the lamp, and in so doing the tungsten draws a spark sufficiently hot to start the arc.

Attempts to use this method with lamps of finer bore have been unsuccessful, since the starting spark is hot enough to melt the tip of the tungsten to a ball which sticks in the capillary. With tubes of 2-mm. bore or more, excess heat does not accumulate in the tungsten and hence it does not melt.

CONTRIBUTION FROM THE
CHEMICAL LABORATORY
MARQUETTE UNIVERSITY
MILWAUKEE, WISCONSIN

RECEIVED MARCH 12, 1936

COMMUNICATIONS TO THE EDITOR

THE PREPARATION OF PHENANTHRYL AMINES AND PHENANTHRYL HALIDES

Sir:

The preparation of 2- and 3-aminophenanthrenes from the corresponding phenanthrenesulfonic acids [Werner, *Ann.*, **321**, 312–321 (1902)] and from the nitrophenanthrenes [Schmidt, *Ber.*, **44**, 1488 (1910)] involves the tedious separation of the isomeric sulfonic acids and nitrophenanthrenes. By hydrolysis of the products obtained by the Beckmann rearrangement of the oximes of 2- and 3-acetylphenanthrenes we have found that the 2- and 3-aminophenanthrenes are formed in excellent yields. Since the necessary ketones are readily obtainable [Mosettig and van de Kamp, THIS JOURNAL, **55**, 3443 (1933)], the procedure constitutes a convenient practical method for making the amines. By this method we have also prepared the new 1-aminophenanthrene (m. p. 145–146°) from the new 1-acetylphenanthrene (m. p. 112–113°) and also the 9-aminophenanthrene.

From the 1-, 2- and 3-aminophenanthrenes, we have synthesized 1-chlorophenanthrene (m. p. 120–120.5°), 2-chlorophenanthrene (m. p. 85.5–86°), 3-chlorophenanthrene (m. p. 80.5–81.5°), 1-bromophenanthrene (m. p. 109.5–110°), 2-bromophenanthrene (m. p. 95–96°), 3-bromophenanthrene (m. p. 83–84°), 1-iodophenanthrene (m. p. 112.5–113°), 2-iodophenanthrene (m. p. 116–116.5°) and 3-iodophenanthrene (m. p. 83.5–84°). All but one of these compounds have not been described previously. The bromo and iodophenanthrenes are being tested for their ability to form Grignard reagents, for the latter should prove useful in the synthesis of phenanthrene derivatives. The details of these experiments will be published later.

CHEMISTRY LABORATORY W. E. BACHMANN
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RECEIVED APRIL 13, 1936

CONCERNING SCHÖNBERG'S CLAIM TO PRIORITY FOR THE BIRADICAL FORMULA OF RUBENES

Sir:

When, indisputably the first to do so, I assigned the biradical formula to the rubenes. I wrote underneath it the two words, "état intermédiaire," in order that there should be no doubt about its role as intermediary in the closed cycle of reactions: rubene + oxygen $\rightleftarrows$ dissociable oxide [*Bull. soc. chim.*, **53,** 838 (1933)]. Moreover, I stated explicitly the structural reasons for the existence of this biradical structure, *viz.*, the presence in the rubene molecule of carbons *"du type des carbones aryl-méthaniques, réputés justement pour l'affaiblissement de leur quatrième valence et les phénomènes de dissociation qui en résultent, comme la scission en radicaux libres,* $Ar_3 \equiv C -$, *par exemple"* (*ibid.*, p. 837).

Finally, I insisted strongly on the reversibility of the whole process: rubene $\rightleftarrows$ dissociable oxide (*ibid.*, p. 836), to the extent of including the word "reversible" in the title of several publications [for example see *Compt. Rend.*, **191,** 1321 (1930)].

I cannot, therefore, now understand Schönberg's insistence, against any evidence, on the priority as to the reversibility in the first period of the transformation, namely, rubene $\rightleftarrows$ biradical form; unless he believes that the process may be reversible in its entirety without being reversible in its parts?

It follows that Schönberg has made no original contribution of any kind to the problem of the rubenes, neither to the idea of reversibility nor to the several theories or constitutions which he has unjustly ascribed to himself [see my claim: *Ber.*, **67,** 1021 (1934)].

COLLÈGE DE FRANCE CHARLES DUFRAISSE
PARIS, FRANCE

RECEIVED FEBRUARY 21, 1936

THE SYNTHESIS OF THE ALDOBIONIC ACID OF GUM ACACIA

Sir:

In 1929 Heidelberger and Kendall [*J. Biol. Chem.*, **84,** 639 (1929)] described a crystalline aldobionic acid, a galactose-glucuronide, obtained from the hydrolysis of gum acacia. This substance was later shown by Challinor, Haworth and Hirst [*J. Chem. Soc.*, 258 (1931)] to be galactopyranose-6-glucuronopyranoside. The configuration of the biose linkage, however, was not at that time fully established. The chemical synthesis of the heptacetyl methyl ester of the aldobionic acid, glucose-6-β-glucuronide, has recently been described by the writers [*Science*, **83,** 353 (1936)]. The present communication deals with an account of the synthesis of the naturally occurring aldobionic acid derived from gum acacia.

When 1-2,3-4 diacetone galactose is condensed with acetobromo glucuronic acid methyl ester [Goebel and Babers, *J. Biol. Chem.*, **111,** 347 (1935)] in ether solution in the presence of silver oxide, the compound 1-2,3-4 diacetone galactose-6-β-triacetylglucuronide methyl ester is formed in yields of 35%. This substance crystallizes in fine needles, melting at 112.5–114°, and shows the rotation $[\alpha]^{25}\mathrm{D}$ $-68.0°$ in chloroform ($C = 1.9\%$) (Found: C, 51.85; H, 6.45; OCH_3, 5.39; $COCH_3$, 21.5). Upon deacetylation with barium hydroxide and subsequent removal of the acetone groups by boiling with dilute sulfuric acid, the above compound is converted into the crystalline aldobionic acid. The synthetic acid is identical in properties with the naturally occurring aldobionic acid obtained from gum acacia. The melting point of a mixture of the two substances shows no depression.

For purposes of further identification, the heptacetyl methyl ester of the synthetic aldobionic acid was prepared. The latter substance is identical in crystalline structure, solubility and melt-