instead of a point of inflection, much more easily interpreted in the author's opinion.

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CONTRIBUTION FROM THE
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Inorganic Lubricants. I. Amalgams.—The great specific gravity and the fluidity of mercury have long permitted its use as a floating and lubricating liquid in the support of astronomical and other heavy moving instruments. Bearings have been operated in a bath of mercury as lubricant.[1]

It has been proposed also to use a film of mercury or amalgam as lubricant on metal bearings,[2] as well as "soft metals" such as copper–zinc amalgams.[3]

For some laboratory operations, such as those involving gases from which aqueous and organic vapors must be excluded, mercury or its fluid amalgams would be found useful as a lubricant for glass stopcocks and ground joints, except for the difficulty in obtaining an adherent film of the metal over the ground-glass surface and so securing the sealing of the joint. This difficulty may, however, be largely overcome in the following manner.

Carefully clean and dry the ground surfaces and then heavily silver them with ammoniacal silver nitrate and rochelle salt solution. Surfaces not to be silvered and passage openings may be protected by a thin layer of paraffin or ceresin wax. Immersion in as many as three to five fresh silvering solutions is usually necessary in order to secure the thickness of silvering required, although this depends upon the exact silvering formula used; too thick deposits obviously lessen the tightness of fit. After each deposition of metal the surface should be well rinsed in distilled water, but otherwise not disturbed.

The silvered surfaces finally obtained are then allowed to dry. Wax coatings on the passage openings should be entirely removed at this time. Amalgam paste or liquid is then dropped on the concave ground surface and the grinding parts are brought together and rotated gently with little contact pressure. Amalgamation of the silver rapidly takes place, and is complete when the motion is smooth and non-gritty, yielding a coherent film over the parts in contact, and tight lubrication.

These amalgamated surfaces are, as a rule, not permanent, but with care will endure through a number of operations lasting over several days, particularly if more amalgam is occasionally applied. They are rapidly destroyed on contact with aqueous solutions of many salts or with acid gases, and may not be used successfully with such materials, although when pure

[1] Harper, U. S. Patent 994,920 (June 13, 1911).

[2] Sherwood, U. S. Patent 1,544,488 (June 30, 1925); 1,598,321 (Aug. 31, 1926).

[3] DeLattre and Hardy, U. S. Patent 1,559,077 (Oct. 27, 1925).

mercury is employed instead of an amalgam, an acid-resisting film is formed the ordinary life of which, however, is shorter than that of films formed with complex liquid amalgams.

The complex amalgam employed may be almost any dilute mercury solution. One such is a mixture of 5 g. of solder, 5 g. of Wood's metal, 2.5 g. of zinc and 80 g. of mercury, solution being effected with heat. Such a liquid also has the curious property of wetting clean, polished glass surfaces with ease.

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STUDIES IN QUINOLINE SYNTHESES

BY WILLIAM LYALL BARR

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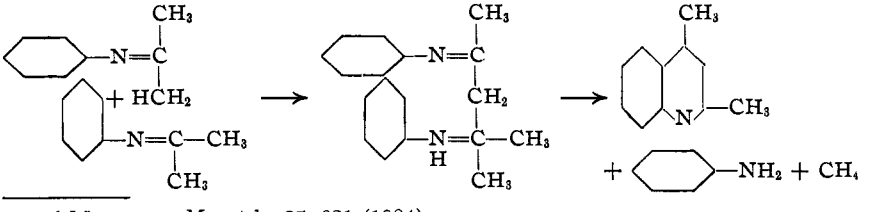
Historical.—The Skraup synthesis is variously formulated as involving intermediate formation of (I) acrolein anil, (II) β-anilinopropionaldehyde or (III) the anil of this aldehyde. The literature affords no definite evidence for the formation of a type I intermediate; there are results compatible with the formation of an intermediate of either type II or type III, but not of type I. Thus Murmann[1] obtained 2-phenylquinoline, not 4-phenylquinoline, by the condensation and oxidation of cinnamaldehyde and aniline, and Blaise and Maire[2] formed 4-ethylquinoline from anilinoethyl ethyl ketone heated with aniline hydrochloride.

From the work of Beyer, Engler and Riehm, and Knoevenagel, the last named investigator has shown[3] that quinoline formation from simple ketones or aldehydes and aromatic amines proceeds by the intermediate formation of ketylidene or alkylidene anils, which form dimerides and then quinoline derivatives; *e. g.*, from aniline and acetone



[1] Murmann, *Monatsh.*, **25**, 621 (1904).

[2] Blaise and Maire, *Bull. soc. chim.*, [4] **3**, 658, 667 (1908).

[3] Beyer, *J. prakt. Chem.*, [2] **31**, 47 (1885); **32**, 125 (1885); **33**, 393 (1886); *Ber.*, **20**, 1767 (1887); Engler and Riehm, *ibid.*, **18**, 2245 (1885); Knoevenagel and v. Baehr, *ibid.*, **55**, 1912 (1922); Knoevenagel and Goos, *ibid.*, **55**, 1929 (1922); Knoevenagel, Wagner and v. Baehr, *ibid.*, **56**, 2414 (1923).