given by Strehlow and von Stackelberg for cadmium in this supporting electrolyte

$$i_t/t^{1/6} = 20.12 + 0.798t^{1/6} \qquad (4)$$

Figure 1 shows a plot of $i_t/t^{1/6}$ against $t^{1/6}$ for the two drops reported,[4] together with the straight line predicted by equation (4). Below $t = 1$ sec., the relatively high back pressure decreases m, and therefore the diffusion current calculated on the assumption that m is invariant with time. However, the experimental values are much too low to be accounted for by any reasonable modification of the theory. Above $t = 1$ sec. the experimental values are too large by as much as 8%, and the "theoretical" slope appears to be attained only as a limit with increasing drop age.

It has been shown[1-4] that, under conditions similar to those prevailing in these experiments, the average current is, very closely, 0.80 times the maximum current instead of the 0.857 predicted by the Ilkovič equation. Equations (1) and (3) yield for the average and maximum currents the values 22.10 and 25.92 microamp., respectively, and the ratio of these figures is 0.853.

From these considerations we conclude that the Strehlow–von Stackelberg equation does not provide a significantly more satisfactory representation than does the Ilkovič equation of the change of instantaneous current with drop age.[8]

Acknowledgment.—This work has been supported by Contract Number AT (30-1)-842 between the Atomic Energy Commission and Yale University.

(8) NOTE ADDED IN PROOF: On the basis of experiments with 1 mM cadmium in 0.5 M potassium chloride–0.01% gelatin, Airey and Smales (*Analyst*, **75**, 287 (1950)) recently concluded that the $i_t/t^{1/6}$ prediction of the Ilkovič equation was obeyed to ±2.5% at drop ages between 0.75 and 3.9 sec. Their values show an ill-defined trend in accord with the experimental curve of Fig. 1, but they do not give sufficient data to allow comparison with the results of Taylor, Smith, and Cooter at very small values of t.

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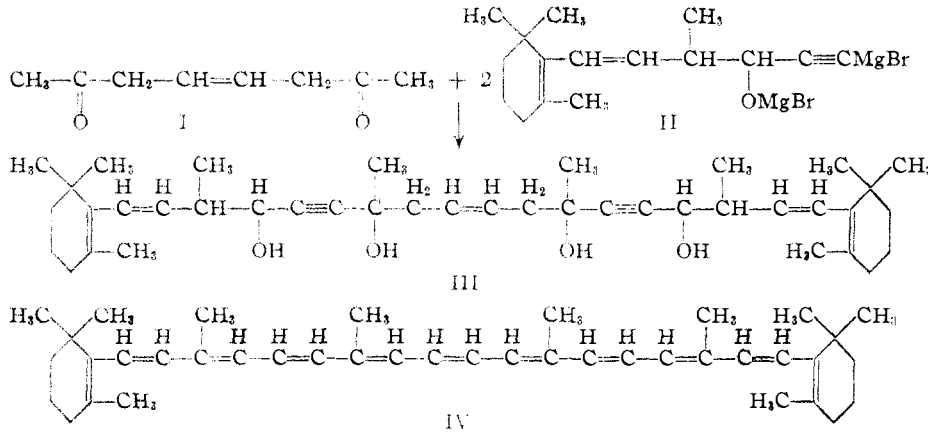
SYNTHESIS OF β-CAROTENE

Sir:

The recent preliminary announcements[1] in Europe of the synthesis of β-carotene prompted us to publish our own synthesis of this carotenoid. In our synthesis the ketone (I)[2] was allowed to react, via the Grignard reaction, with two moles of the acetylene carbinol (II) prepared from the C_{14}-aldehyde[3] to form the tetrol (III). This tetrol was selectively hydrogenated with two moles of hydrogen in the presence of palladium deposited on calcium carbonate, and the resulting product dehydrated with four mole-equivalents of pyridine hydrobromide in boiling pyridine.[4] The crude deep red product was recovered and chromatographed through a calcium hydroxide column. Typical carotene zones were formed and from these was isolated a product which upon



two crystallizations from a benzene–methanol mixture gave red hexagonal and rhombic plates typical of β-carotene, m. p. 179–181°. A mixed m. p. with an authentic sample of natural β-carotene gave no depression. No mixed chromatogram tests were carried out. Our synthetic β-carotene gives a deep blue color with antimony trichloride in chloroform and an absorption spectrum in benzene identical with that of the natural β-carotene. It showed maxima (Beckman Model DU) at 429 (inflection), 454, and 484 mμ, respectively. The principal maximum at 454 mμ had an $E^{1\%}_{1\,cm.}$ value of about 2000. This work is being actively continued and detailed results will be reported elsewhere.

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(1) (a) Karrer and Eugster, *Compt. rend.*, **230**, 1920 (May 31, 1950); (b) Inhoffen, Bohlmann, Bartram and Pommer, *Chemiker-Ztg.*, **74**, 285 (1950); (c) Inhoffen, Pommer and Bohlmann, *ibid.*, **74**, 309 (1950).

(2) This ketone was first synthesized in this Laboratory by E. E. Mange, B.S. Thesis, M. I. T., 1948.

(3) Milas, *et al.*, THIS JOURNAL, **70**, 1587 (1948).

(4) Milas, *et al.*, *ibid.*, **70**, 1597 (1948).