TABLE I

SUMMARY ON LANTHANUM–NEODYMIUM SEPARATIONS

Method	Ppt. (g. oxide)	% Nd in ppt.	% Nd in in filtrate	More soluble element
Sulfate[1]	2.9	24	35	Nd
Oxalate[1]	3.1	43	16	La
Alkali carbonate[1]	5.3	25	62	Nd
NH_4 double nitrate[1]	3.5	20	44	Nd
Basic magnesia[1]	1.2	61	22	La
Basic ammonia[2]	2.3	59	11	La
Basic urea[3]	1.9	43	23	La
Basic electrolytic[4]	1.0	60	24	La

procedures, has unfortunately the same serial solubility order as the basic precipitations. The ammonium double nitrate seems to be the next best choice.

(1) Procedure as in Little, "Textbook of Inorganic Chemistry" (Friend), Griffin, London, 1917.

(2) This is Prandtl's modification, using $Cd(NO_3)_2 + NH_4NO_3$, of the straight ammonium hydroxide basic separation [Prandtl and Hüttner, *Z. anorg. allgem. Chem.*, **136**, 289 (1924)].

(3) Six grams of mixed oxides was converted to nitrates, almost neutralized with ammonium hydroxide and diluted to 1 liter. Ten grams of urea was added and the mixture was kept at the boiling point for four hours. The precipitate formed was quite granular. The writer is indebted to Professor H. H. Willard of the University of Michigan for suggesting this method. He understands that Professor Willard has made an exhaustive study of the use of urea as an analytical reagent for group three elements.

(4) Dennis and co-workers, THIS JOURNAL, **37**, 131, 1963 (1915); **40**, 174 (1918). Neckers and Kremers, *ibid.*, **50**, 950 (1928).

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RECEIVED AUGUST 2, 1933
PUBLISHED DECEMBER 14, 1933

A Mercury Seal for Stirrers

BY D. T. ROGERS

In the past mercury seals for stirrers used in this Laboratory were made from Pyrex glass. They frequently broke because of improper annealing and careless handling.

To overcome these difficulties seals have been made from steel which have proved very satisfactory. The seals made from Allegheny metal No. 22 have remained unattacked after six months of service. Those made from soft steel and covered with a coat of paint have also proved quite satisfactory. The seals weigh about 200 g. and can be used at speeds up to 1000 r. p. m. The upper part of the seal is not shown in the diagram. It consists of either a thin-walled glass or steel cylinder which is fitted to the stirrer shaft with any ordinary rubber stopper. Dimensions are such that stoppers can be changed without dismantling the seals.

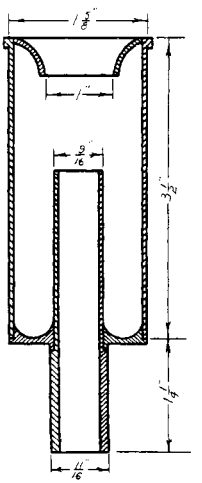

Fig. 1.

The seals were made by A. Bigelman, 1314 Third Avenue, Watervliet, N. Y.

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RECEIVED OCTOBER 10, 1933
PUBLISHED DECEMBER 14, 1933

[CONTRIBUTION FROM THE CHEMICAL LABORATORY OF NORTHWESTERN UNIVERSITY]

The Pyrolysis of Hydrocarbons. Further Studies on the Butanes[1]

BY CHARLES D. HURD[2] AND FORREST D. PILGRIM[3]

Recent work on the pyrolysis of the butanes[4-10] has elucidated much of the problem but such questions as the following seemed important for further study: (1) the reaction products at incipient decomposition, (2) the importance of the contact time, (3) the relationship of temperature and contact time, (4) the influence of metal reaction tubes. These items, among others, have been considered in the present paper.

The Reaction Products at Incipient Decomposition.—There are two approaches to this problem. One is to extrapolate the quantities of products formed at real conditions to their value at zero decomposition.[8] This method has been considered in the present paper. The other, which will be taken up in the following paper, is to carry out the pyrolysis at a very low decomposition temperature.[10]

The set-up for the pyrolysis experiments was essentially the same as that of Hurd and Spence.[4] The gas was forced through the reaction tube by a head of water. The customary flowmeters, manometer, drying towers and collecting bottles were in the train. Various size reaction tubes and furnaces were used. The gases were analyzed either by the absorption and combustion method[4] or by precision fractional distillation in a column of the type described by Oberfell and Alden[11] and Podbielniak,[12] or by a combination of these methods. The *n*-butane for this work was generously furnished by F. E. Frey of the Phillips Petroleum Company. Distillation analysis confirmed its purity. Less than 1% of low boiling material and

(1) A part of this investigation was financed from funds donated to the American Petroleum Institute by the Universal Oil Products Co. The investigation was listed as Project No. 18.

(2) Director, Project No. 18.

(3) American Petroleum Institute Research Fellow.

(4) Hurd and Spence, THIS JOURNAL, **51**, 3353 (1929).

(5) Pease, *ibid.*, **50**, 1779 (1928); Pease and Durgan, *ibid.*, **52**, 1262 (1930).

(6) Hague and Wheeler, *J. Chem. Soc.*, 378 (1929).

(7) Frolich, Simard and White, *Ind. Eng. Chem.*, **22**, 240 (1930).

(8) Schneider and Frolich, *ibid.*, **23**, 1405 (1931); Neuhaus and Marek, *ibid.*, **24**, 400 (1932).

(9) Frey and Huppke, *ibid.*, **25**, 54 (1933).

(10) Norris and Thomson, THIS JOURNAL, **53**, 3108 (1931); Norris, *J. Chem. Educ.*, **9**, 1890 (1932); Norris and Standley, paper before the Organic Division, A. C. S. meeting at New Orleans, April, 1932.

(11) Oberfell and Alden, *Oil Gas J.*, **27**, 142 (1928).

(12) Podbielniak, *ibid.*, **28**, 58 (1929); **29**, 235 (1930).