FARADAY'S ENCYCLOPEDIA

OF

HYDROCARBON COMPOUNDS

VOLUME 8

$C_{11}H_{8-16}$

FARADAY ENCYCLOPEDIA

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$C_{11}H_{8-16}$

VOLUME 8

Compiled by

J. E. FARADAY, (Rocca) B.Sc., Ph.D.

and

A. S. FREEBORN, B.Sc., Ph.D., F.R.I.C.

The Information in this Volume covers the Literature up to 1 January, 1959 and comprises :

The ORIGINAL VOLUME up to 1 January, 1949,

The FIRST REPLACEMENT-ADDITION ISSUE for $C_{11}H_{8-16}$ up to 1 January, 1951,

The SECOND REPLACEMENT-ADDITION ISSUE for $C_{11}H_{8-16}$ up to 1 January, 1954,

The THIRD REPLACEMENT-ADDITION ISSUE for $C_{11}H_{8-16}$ up to 1 January, 1959.

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THE PURPOSE OF THE FARADAY ENCYCLOPEDIA: HYDROCARBON COMPOUNDS

To survey the chemical literature for all available published information on an organic compound comprehensively it is necessary to consult Beilstein's *Handbuch der Organischen Chemie* and the three abstract Journals, namely *Chemical Abstracts, British Abstracts* and *Chemisches Zentralblatt.* Although each abstract journal aims at complete coverage of the literature, information appears in one that does not appear in the other two and therefore to use anything less than all three may lead to the omission of some vital information.

The survey involves a search through some thirty to forty different indexes—the number varying from time to time on publication of new or cumulative indexes—and then, except for Beilstein, turning to text pages of the abstract journals themselves for original references. The work involved varies from compound to compound depending on the information sought; a general opinion is that an exhaustive survey may easily mean a week's search of the literature.

The purpose of this ENCYCLOPEDIA is to reduce tedious labour in the case of hydrocarbons. Under each compound is gathered the material in or a reference to Beilstein and the material in the three abstract journals relating to the most useful features, namely :—

The molecular formula
The structural formula
The names
The occurrence in Nature
Melting points
Freezing points
Boiling points
Densities
All known methods of preparation
Recommended laboratory methods of preparation
Refractive Indexes
Methods of detection and determination
Derivatives for identification.

By using the loose leaf system, information about each compound is gathered into one place and consultation is thus confined to a reference to this one place instead of a search through the thirty to forty indexes. Additionally actual references to the original literature are quoted in this one place. Further by publication of Replacement-Addition Issues at frequent intervals the information is kept up to date and the new matter joins the old in its one fixed place in the ENCYCLOPEDIA.

The greatest saving of time made by the use of the ENCYCLOPEDIA would be when it is desired to ascertain if a compound has yet been described. Consulting the ENCYCLOPEDIA will give the answer in a few minutes. Without it the full search of the literature is necessary.

The aim has naturally been to make the ENCYCLOPEDIA complete but errors and omissions are possible in a work of this magnitude. The publishers would be grateful if users would point out any errors or omissions they find for such imperfections can be corrected through future Replacement-Addition Issues.

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THE REPLACEMENT-ADDITION ISSUES

The information in this volume covers the chemical literature as reported in Beilstein and the Abstract Journals up to 1 January, 1959.

Further REPLACEMENT-ADDITION ISSUES will be published for this volume at intervals so that the information will be only a year or two behind the published literature.

If the information in this volume is two or more years out of date, REPLACEMENT-ADDITION ISSUES may have been published but have not been inserted in this copy. Please write to

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THIRD REPLACEMENT-ADDITION ISSUE for Volume 8 up to 1 January, 1959 inserted.

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FOREWORD

In this and the previous volumes of the ENCYCLOPEDIA the aim has been to provide a standard record of all known hydrocarbons with enough detail about each compound as to direct workers to the particular original papers as would best suit their purpose.

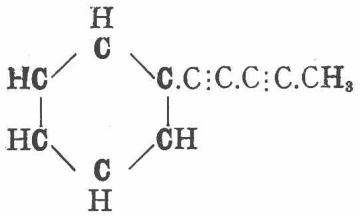
Nine volumes have been required to cover C_1 to C_{11} and the possibility of reducing the number required to complete the work has been carefully investigated. It is very likely that Beilstein's ORGANISCHE CHEMIE and Egloff's PHYSICAL CONSTANTS OF HYDROCARBONS will be available to users of the ENCYCLOPEDIA and so it is considered that by not presenting the information already contained in these standard works, the advantage of completing the ENCYCLOPEDIA more expeditiously and in fewer volumes will outweigh the disadvantage of asking users to consult Beilstein and Egloff as well.

Accordingly with the C_{12} volumes onwards the information in Beilstein will not be translated and quoted. The volume, supplement and page references to Beilstein and the volume and page references to Egloff will be given just below the name of each compound. The preferred values of physical constants in Egloff will continue to be quoted, however.

The information presented in detail in the ENCYCLOPEDIA will be that information which has appeared in the original literature, as quoted in the Abstract Journals, British Abstracts, Chemical Abstracts and Chemisches Zentralblatt, since the closing dates of the appropriate sections of the standard works, Beilstein and Egloff.

Dr. G. Malcolm Dyson has informed the author that he intends to modify his scheme of ciphering. The changes will render obsolete those ciphers quoted for the C_{10} compounds. In the circumstances Dyson ciphers will no longer be quoted, at least until the situation stabilises.

JOSEPH E. FARADAY.



$C_{11}H_8$
F 855

PENTADIYNE-(1,3)-YL-BENZENE
1,3-PENTADIYNYL-BENZENE
1,3-PENTADIINYL-BENZENE
PENTA-αγ-DIYNYL-BENZENE
PENTA-1,3-DIYNYL-BENZENE
1-PHENYL-PENTADIYNE-(1,3)
1-PHENYL-1,3-PENTADIYNE
1-PHENYL-1,3-PENTADIINE
α-PHENYL-Δ-αγ-PENTADIINENE
α-PHENYL-PENTA-αγ-DIYNE
1-PHENYL-PENTA-1,3-DIYNE
METHYL-PHENYL-DIACETYLENE

PREPARED : SHEET 1

P1 by treating 1-phenyl-pentadiene-(1,3) with bromine and boiling the mixture obtained with ethanolic potash (*C. r.* **180,** 1852 ; *A. Ch.* (10), **10,** 372) ;

PROPERTIES :

CX1 Plates (*item P*1) ;

CM1 Mp 22.45° (*item P*1) ;

CB1 Bp 129° at 20 mm. (*item P*1) ;

CD1 Density (18/4) 0.9745 (*item P*1) ;

CN1 Refractive Index (18/D) 1.6368 (*item P*1) ;

CP1 Physical constants (*Egloff* **III,** 257) (*E*) ;

POLYMERIC HYDROCARBON $(C_{11}H_8)_x$

F - - -

PREPARED : SHEET 1

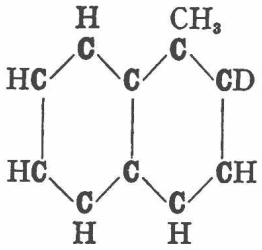
P1 by thermal decomposition of 2-bromo-methyl-naphthalene (*Rec.* 1938, **57,** 90 ; *C.* 1938, **I,** 3042) (*C*) ;

P2 by decomposition of 2-bromo-methyl-naphthalene in presence of Fe_2O_3 (*Rec.* 1938, **57,** 1117) (*C*) ;

1,2,3,4,5,6,7,8,11,11,11-DECADEUTERO-METHYL-NAPHTHALENE
D-METHYL-NAPHTHALENE

PREPARED : | SHEET 1

P1 from toluene with ND_3 (*Doklady Akad. Nauk SSSR* 1951, **79,** 479 ; *CA* 1952, **46,** 30/*a*) (*A*) ;



$C_{11}H_9D$

F 011

2-DEUTERO-1-METHYL-NAPHTHALENE
β-DEU1ERO-α-METHYL-NAPHTHALENE

PREPARED : SHEET 1

P1 from the magnesium compound of 2-bromo-1-methyl-naphthalene and D_2O, in 31% yield (*Chem. Ber.* 1953, **86**, 214; *C.* 1955, 5774) (*C*) ;

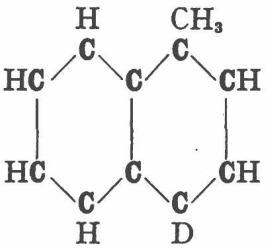
PROPERTIES :

CM1 Mp 33.5° (*item P*1) ;

CB1 Bp 106° at 7 mm (*item P*1) ;

CD1 Density (40/4) 0.9974 (*item P*1) ;

CN1 Refractive Index (40/D) 1.60216 (*item P*1) ;



$C_{11}H_9D$

F 011

4-DEUTERO-1-METHYL-NAPHTHALENE
δ-DEUTERO-α-METHYL-NAPHTHALENE

PREPARED : SHEET 1

P1 from the magnesium compound of 4-bromo-1-methyl-naphthalene and D_2O in ether at -20°C, in 42% yield (*Chem. Ber.* 1953, **86**, 214 ; *C.* 1955, 5774) (*C*) ;

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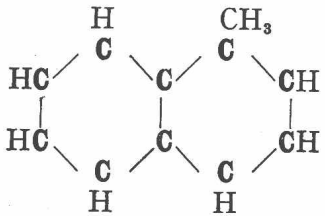
PROPERTIES :

CB1 Bp 123° at 12 mm (*item P*1) ;

CD1 Density (20/4) 1.0144 (*item P*1) ;

CN1 Refractive Index (20/D) 1.60587 (*item P*1) ;



$C_{11}H_{10}$

F 011

1-METHYL-NAPHTHALENE
α-METHYL-NAPHTHALENE

OCCURS : SHEET 1

O1 in petroleum (*GP* 95579 ; *JCS* **91,** 1149) ;
O2 in New Zealand petroleum (*Chemistry and Industry* 1923, 938 ; *C.* 1924, **I,** 2847) ;
O3 in coke tar (*IEC* **15,** 1022 ; *C.* 1924, **I,** 1294) ;
O4 in coal tar (*J. Fuel Soc. Japan* **7,** 61 ; *C.* 1928, **II,** 1733) ;
O5 in a neutral oil fraction from low temperature tar (*JSCI* 1934, **53,** 73*T*) (*C*) ;
O6 in coal tar (*Ber.* 1935, **68,** 11 ; *C.* 1935, **I,** 1476) (*C*) ;
O7 in Rumanian petroleum (*Petroleum* 1935, **31,** *No.* 41, 5 ; *C.* 1936, **I,** 1758) (*C*) ;
O8 in Siberian coal tar (*Khim. Tverdogo Topliva* 1935, **6,** 217 ; *C.* 1936, **II,** 3966) (*C*) ;
O9 in coal tar (*Ber.* 1936, **69,** 1722 ; *C.* 1936, **II,** 1823) (*C*) ;
O10 in low temperature coal tar (14 *Congr. Chim. Ind. Paris* 1934, 13 ; *C.* 1936, **I,** 2257) (*C*) ;
O11 in tar from petroleum (*Khim. Tverdogo Topliva* 1936, **7,** 748 ; *CA* 1937, **31,** 2800/9 ; *C.* 1937, **I,** 3435) (*A,C*) ;
O12 in coal tar (*Contrib. Inst. Chem. Natl. Acad. Peiping* 1936, **1,** 153 ; *C.* 1937, **II,** 3413) (*C*) ;
O13 in Rumanian petroleum (*Petroleum* 1938, **34,** 3 ; *C.* 1938, **II,** 232) (*C*) ;
O14 in the kerosene fraction of petroleum (*J. Res. Nat. Bur. Stds.* 1940, **24,** 395 ; *CA* 1940, **34,** 6803/2) (*A*) ;

OCCURS : SHEET 2

O15 in the middle fraction of petroleum from Gura-Ocnitei (*Österr. Chemiker Ztg.* **1939**, **42**, 350 & 352 ; *CA* 1940, **34**, 611/5) (*A*) ;

O16 in low temperature tar oil (*Oel u. Kohle ver. Petrol.* 1939, **35**, 770 ; *CA* 1940, **34**, 6044/5) (*A*) ;

O17 in crude Karwendol oil (*Arch. Pharm.* 1940, **278**, 360 ; *CA* 1941, **35**, 3629/8) (*A*) ;

O18 in tar oil fractions (*JSCI* 1941, **60**, 123 ; *CA* 1941, **35**, 6253/1) (*A*) ;

O19 in an aromatic kerosene fraction (*J. Research Natl. Bur. Standards* 1941, **27**, 343 ; *CA* 1942, **36**, 643/7 (*A*) ;

O20 in tar oil fractions (*JSCI* 1943, **62**, 177 ; *CA* 1944, **38**, 2029/9) (*A*) ;

O21 in the 190-252° fraction of Surakhan petroleum (*Doklady Akad. Nauk SSSR* 1949, **67**, 847 ; *CA* 1950 **44**, 1942/*a*) (*A*) ;

O22 in coal tar (*J. Chem. Soc. Japan* 1949, **52**, 201 ; *CA* 1951, **45**, 4428/*d*) (*A*) ;

O23 in the kerosene fraction of Maikop petroleum (*Doklady Akad. Nauk SSSR* 1950, **73**, 715 ; *CA* 1951, **45**, 1566/*i*) (*A*) ;

O24 in Surakhan petroleum (*Doklady Akad. Nauk SSSR* 1951, **80**, 769 ; *CA* 1952, **46**, 5301/*b*) (*A*)

O25 in West Edmond crude oil (*Anal. Chem.* 1951, **23**, 129, *CA* 1951, **45**, 4028/*h* ; *BA* 1951 *C* 211) (*A*, *B*) ;

O26 in Turkmen petroleum (*Izvest. Akad. Nauk Turkmen S.S.R.*, 1955, 61 ; *CA* 1956, **50**, 17399/*b*) (*A*) ;

O27 in neutral oil fraction, Bp 200-230°, of pit-coal (*Erdöl u. Kohle* 1955, **8**, 629 ; *C.* 1956, 8515) (*C*) ;

O28 in small amount in higher boiling fraction from Osaka gas (*J. Chem. Soc. Japan Ind. Chem. Sect.* 1957, **60**, 928 ; *C.* 1958, 2319) (*C*) ;

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Replace it with this

PREPARED : SHEET 1

P1 by the dry distillation of coal tar (*Ber.* **17,** 844 & 1528) ;

P2 from coal gas manufacture (*RCS* **31,** 358 ; *C.* 1899, **II,** 118) ;

P3 by the action of ethylene-bromide in aluminium-chloride on naphthalene and distillation of the reaction product, with 2-methyl-naphthalene (*A. Ch.* (6), **12,** 299) ;

P4 from 1-bromo-naphthalene with sodium and methyl-iodide (*Ann.* **155,** 114) ;

P5 by roasting 1-naphthyl-acetic-acid with lime (*Ber.* **16,** 1547) ;

P6 from coal tar fractions (*Ber.* **24,** 3918 ; *J. Pr. Chem.* (2), **46,** 317) ;

P7 from petroleum distillation products (*Ber.* **17,** 854) ;

P8 by leading acetylene mixed with hydrogen and methane at 600° through a packed tube (*Ber.* **47,** 2769) ;

P9 by dehydrogenation of a neutral oil fraction of brown coal tar with sulphur at 240° (*Ber.* **60,** 897) ;

P10 by prolonged heating of retene under 70-75 atms. hydrogen pressure at 450-470° in presence of iron-oxide and alumina, etc. (*Ber.* **62,** 716 ; *RCS* **60,** 1454) ;

P11 by thermal decomposition of 1-methyl-3,4-dihydro-naphthalene (*Ber.* **58,** 151) ;

P12 by prolonged heating of chrysene with hydrogen in presence of anhydrous ferric-chloride at 440-450° and at first 85 atms. and later at 100 atms. (*Ber.* **62,** 720 ; *RCS* **61,** 1182) ;

P13 by strongly heating 1-methyl-1,2,3,4-tetrahydro-naphthol-(1) with phosphorous-pentoxide at 80° (*Ber.* **58,** 154) ;

P14 by long heating of phenyl-α-naphthyl-ether with sodium in a tube at 100° (*Ber.* **59,** 2512) ;

P15 by vacuum distillation of a mixture of the barium salt of 1-methyl-3,4-dihydro-2-carboxy-naphthalene and sodium-methoxide (*Ber.* **58,** 151) ;

P16 by heating the calcium salt of 1-methyl-3-carboxy-naphthalene with burnt lime (*C. r.* **183,** 750) ;
P17 by the action of dimethyl-sulphate on 1-naphthyl-magnesium-bromide (*C. r.* **172,** 1504 ; *Bl.* (4), **31,** 696) ;
P18 by decomposition of 2-hydroxy-di-α-naphthyl-methane at 250-260° and 80-100 atms. in presence of nickel-oxide, with naphthalene (*Bl.* 1929, (4), **45,** 950) (*B*) ;
P19 by heating 1-methyl-3-carboxy-naphthalene with calcium-carbonate (*C. r.* 1926, **183,** 748) (*A*) ;
P20 preparation, with 2-methyl-naphthalene (*BP* 260604 ; *CA* 1927, **21,** 3370) (*A*) ;
P21 from naphthalene with formaldehyde in presence of HCl and reduction (*GP* 509149 ; *C.* 1931, **I,** 360) (*C*) ;
P22 from brown coal gas benzine and tar oil (*Z. angew. Chem.* 1931, **44,** 75 ; *C.* 1931, **I,** 2559) (*C*) ;
P23 from 1-halogeno-naphthalene with lithium in ether in a stream of nitrogen and treatment with dimethyl-sulphate (*Coll. Czech. Chem. Comm.* 1932, **4,** 139 ; *C.* 1932, **I,** 3060) (*C*) ;
P24 from 1-chloromethyl-naphthalene in ethanol with HCl and zinc (*JCS* 1933, 485) (*C*) ;
P25 from 1-chloro-, 1-bromo- or 1-iodo- naphthalene with lithium and subsequent treatment with dimethyl-sulphate (*Chem. Listy* 1932, **26,** 495 ; *C.* 1933, **I,** 3079) (*C*) ;
P26 by dehydrogenation of 4-methyl-tetrahydro-naphthoic-acid with selenium or sulphur (*C. r.* 1934, **199,** 1131 ; *CA* 1935, **29,** 1084/4 ; *C.* 1935, **I,** 2361) (*A,C*) ;
P27 by dehydrogenation of 5-methyl-1,2,3,4-tetrahydro-naphthalene (*JSCI* 1935, **54,** *T*208 ; *C.* 1935, **II,** 3236) (*C*) ;
P28 see *JCS* 1935, 735 ; *C.* 1935, **II,** 1358 (*C*) ;
P29 by destructive hydrogenation of crude anthracene (*J. Applied Chem. USSR* 1935, **8,** 889 ; *C.* 1936, **I,** 2480) (*C*) ;

P30 from 1,8-naphthalic-anhydride with selenium and cholesterol at 320-330° (*Ber.* 1935, **68,** 2245 ; *C.* 1936, **I,** 1237) (*C*) ;

P31 from naphthalene and methyl-iodide in carbon-disulphide in presence of aluminium-chloride, with 2-methyl-naphthalene (*Contrib. Inst. Chem. Natl. Acad. Peiping* 1936, **2,** *No.* 8, 127 ; *CA* 1937, **31,** 6646/6 ; *C.* 1937, **II,** 2523) (*A,C*) ;

P32 by dehydrogenation of cis-1-methyl-decalin (*JCS* 1937, 1146 ; *CA* 1937, **31,** 7051/7) (*A*) ;

P33 from the dehydrogenation of 1, 8 - dimethyl-hydrindanone- (2) (?) (*JCS* 1938, 660 ; *C.* 1938, **II,** 1031) (*C*) ;

P34 from lithium-1-naphthyl and methyl-iodide in high yield and from 1-naphthyl-bromide and lithium-methyl very slowly (*JACS* 1940, **62,** 1843 ; *CA* 1940, **34,** 6603/5) (*A*) ;

P35 from cis-9-methyl-decahydro-naphthalene or cis-9-methyl-octahydro-naphthalene in presence of platinum or palladium on asbestos, with other products or from cis-4, 9-dimethyl-octahydro-naphthalene dehydrogenated with platinised carbon and asbestos, with other products (*JCS* 1940, 1127) (*B*) ;

P36 by polymerisation of acetylene at 595-608°, with other products (*Kwagaku Kogyo Siryo* 1940, **13,** 230 ; *CA* 1941, **35,** 4181/6) (*A*) ;

P37 from 1-methyl-trans-decahydro-naphthalene with palladium on charcoal in presence of hydrogen at 350° (*JACS* 1943, **65,** 1085) (*B*) ;

P38 in good yield from naphthalene in the steps $C_{10}H_8$ to $1\text{-}C_{10}H_7.CH_2Cl$ (70-72% yield) to $1\text{-}C_{10}H_7.CH_2.MgBr$ (88-92%) to $1\text{-}C_{10}H_7.CH_3$ (80%) (*JACS* 1943, **65,** 295 ; *CA* 1943, **37,** 1712/9) (*A*) ;

P39 by dehydrogenation of 1-methyl-1,2,3,4-tetrahydro-naphtahlene with sulphur (*C. r. Acad. Sci. URSS* 1943, **39,** 311 ; *BCA* 1944 *AII* 328) (*B*) ;

P40 from tar oil fractions (*JCSI* 1943, **62,** 177 ; *CA* 1944, **38,** 2029/9 ; *BCA* 1944 *BII* 1) (*A,B*) ;

P41 by refluxing 5-methyl-tetralin and 6-methyl-tetralin with sulphur for 4 hours, with 2-methyl-naphthalene (*JACS* 1943, **65,** 2393 ; *CA* 1944, **38,** 735/4) (*A*) ;

P42 by fractional distillation of suitable high temperature neutral tar oil (*JSCI* 1941, **60,** 123 ; *BCA* 1941 *BII* 210) (*B*) ;

P43 from methyl-iodide or methyl-bromide and 1-naphthyl-magnesium-bromide in presence of ferric-chloride, in 50% yield (*C. r.* 1944, **218,** 557 ; *BA* 1945 *AII* 291) (*B*) ;

P44 by vapour phase methylation of naphthalene with methyl-chloride at 250-500° in presence of alumina, alumina : silica or aluminium-chloride : charcoal, in 15% yield (*JACS* 1945, **67,** 1312 ; *CA* 1946, **40,** 68 ; *BA* 1946 *AII* 13) (*A,B*) ;

P45 by catalytic dehydrogenation of 1-(1,2,3,4-tetrahydro-1-naphthyl)-3-butanone with palladium on charcoal in 14% yield (*JACS* 1946, **68,** 258 ; *CA* 1946, **40,** 2137/6) (*A*) ;

P46 by passing gasoline from 27 API Texas crude over copper-iron turnings (5 : 1) at 650°, with other products (*USP* 2397715 ; *CA* 1946, **40,** 3252/9) (*A*) ;

P47 by reduction of tetrahydro-sesquibenihene with sodium followed by dehydrogenation with selenium (*J. Chem. Soc. Japan* 1942, **63,** 1470 ; *CA* 1947, **41,** 3448/*d*) (*A*) ;

P48 by hydrogenation of 1-naphtho-nitrile at 270-290° using a nickel or nickel-copper catalyst on diatomaceous earth in 97% yield (*Bull. Inst. Phys. Chem. Research (Tokyo), Chem. Ed.* 1944, **23,** 296 ; *CA* 1948, **42,** 6783/*c*) (*A*) ;

PREPARED : SHEET 5

P49 from 1-naphthyl-cyanide by hydrogenation in presence of a nickel catalyst at 270-280° (*Bull. Inst. Phys. Chem. Research (Tokyo) Chem. Ed.* 1944, **23,** 224 ; *CA* 1949, **43,** 7916/*b*) (*A*) ;

P50 by methylation of naphthalene by means of various agents in presence of various catalysts, with other products (*JCS* 1948, 1700 ; *CA* 1949, **43,** 2197/*a* ; *BA* 1949 *AII* 209) (*A,B*) ;

P51 by sulphonation of a coal tar fraction and decomposition of the sodium salt with sulphuric-acid (*J. Inst. Petroleum* 1948, **34,** 677 ; *CA* 1949, **43,** 2608/*b* ; *BA* 1949 *AII* 73) (*A,B*) ;

P52 by passing a petroleum charge stock through tubes packed with a hydrogenating dehydrogenating catalyst, *e.g.* copper at 630-680°, with other products (*JSCI* 1948, **67,** 114 ; *BA* 1949 *BII* 198) (*B*) ;

P53 by dehydrogenation of bicyclo-(5,4,0)-undeca-2,4,7[1]-triene-X-carboxylic-acid in the liquid phase at 270° over 20% palladium on carbon (*JCS* 1949, 2421 ; *CA* 1950, **44,** 2972/*g* ; *BA* 1950 *AII* 502) (*A,B*) ;

P54 from the preparation of acenaphthylene by vapour phase catalytic dehydrogenation of acenaphthene (*JSCI* 1949, **68,** 228 ; *CA* 1950, **44,** 2966/*b* ; *BA* 1950 *BII* 430) (*A,B*) ;

P55 by dehydrogenation of 1-methyl-1-ethyl-tetrahydro-naphthalene over nickel at 375° in 35-55% yield, of 1-phenyl-1-methyl-tetrahydro-naphthalene over nickel at 350° in 12% yield and of 1,1-dimethyl-1,2,3,4-tetrahydro-naphthalene over platinum at 350° in 25% yield (*JACS* 1949, **71,** 2955 ; *BA* 1950 *AII* 504) (*B*) ;

P56 by modified Wolff-Kishner reduction of 1-$C_{10}H_7$.CH:N.NH.CO.NH_2 in 71% yield (*JACS* 1949, **71,** 3301 ; *CA* 1950, **44,** 1121/*g*) (*A*) ;

