An A.C. Double Bridge with Inductively Coupled Ratio Arms for Precision Platinum-Resistance Thermometry

J. J. HILL and A. P. MILLER, *Proc. Instn. Elect. Engrs.*, 1963, **110**, (2), 453–458

Errors in the measurement of resistance of a Pt-resistance thermometer can be reduced to a few parts in 10^7 by the use of an a.c. double bridge circuit with inductively-coupled ratio arms which give accuracy, stability, low temperature coefficient, high input impedance and low output impedance. Details of a 400 c/s, 8 decade dial bridge are given. Errors due to the leads are reduced to 0.0001°C between −100°C and +100°C and are unlikely to exceed 0.0003°C over the range −183°C to +630°C.

NEW PATENTS

Isomerisation of Paraffin Hydrocarbons

THE BRITISH PETROLEUM CO. LTD. *British Patent* 918,803

C_4 and higher paraffin hydrocarbons boiling in gasoline range are isomerised by contact, in the presence of hydrogen, with a catalyst composed of an aluminium halide and 0.01 to 5% by wt. of platinum or palladium, supported on alumina, made from an aluminium alcoholate by hydrolysis to hydrated alumina followed by calcination.

Catalyst for Selective Hydrogenation

CHEMETRON CORP. *British Patent* 920,012

A catalyst for use in the selective hydrogenation of highly unsaturated hydrocarbons contained in concentrated olefin streams is composed of palladium metal on an alumina carrier, the catalyst having a pore volume of surface pores with a threshold diameter of not over 800 Å in the range of between 0.0 and 0.4 cc/g, the palladium being mainly concentrated on the external surface of the alumina.

Penicillins

BEECHAM RESEARCH LABORATORIES LTD. *British Patent* 920,300

A palladium or platinum on barium carbonate or carbon catalyst is used in a hydrogenating step in the preparation of new penicillins.

Thermal Radiation Sources

THE GENERAL ELECTRIC CO. LTD. *British Patent* 921,233

A thermal radiation source includes an open-fronted vessel containing a radiator and provided with a gas inlet and a screen of fine refractory wires closely spaced and extending across the open front so as to permit radiation to emerge from the vessel but to obstruct the ingress of ambient gas. The wires are made of a platinum group metal, e.g. 70% platinum and 30% iridium.

Getters

UNION CARBIDE CORP. *British Patent* 921,273

A heat-insulating system comprises a liquefied gas container having an evacuated space between an inner and outer wall and a hydrogen-selective getter in the form of palladium oxide exposed to the space and placed adjacent the outer wall. The palladium oxide is used together with a non-hydrogen-selective getter placed near the inner wall.

Manufacture of Palladium Catalysts

LAPORTE CHEMICALS LTD. *British Patent* 922,022

A porous carrier is first treated with a palladium-containing liquor in amount such that all is taken up and in concentration to give required palladium content. Before or after such treatment, the carrier is treated with an aqueous solution of a base derived from an alkali- or an alkaline earth-metal to fix the palladium and is partially or completely dried between these treatments.

Hydrogen Permeation Cell

THE ATLANTIC REFINING CO. *British Patent* 922,103

The palladium or palladium alloy (10-50% Ag-Pd) capillary tubes of a hydrogen permeation cell are arranged in a cluster and secured at one end but unsupported against either the remainder of the outer wall or inner wall except as against one another in the cluster.

Coating of Metal

ENGELHARD INDUSTRIES INC. *British Patent* 922,105

A molten platinum group metal is sprayed on to a clean surface of molybdenum, tantalum, tungsten or titanium as a thin coat which is then plastically deformed at 600°–1400°C and long enough to promote solid diffusion of the coating and repeating these steps until the required thickness of platinum is attained.

Isomerisation Process

ESSO RESEARCH & ENGINEERING CO. *British Patent* 922,213

The catalyst used in isomerising C_5 or C_6 paraffins is a supported platinum or palladium catalyst containing aluminium chloride. Reaction carried out at 200°–400°F and pressure of 700–1500 p.s.i.g.

Catalysts

ENGELHARD INDUSTRIES INC. *British Patent* 922,381

A catalyst consists of a support of a glass fabric coated with alumina or other refractory and carrying platinum or palladium or an oxide thereof as

the active material. Made by applying a dispersion of a refractory precursor to glass fabric (woven, knitted or crocheted), converting the precursor to a solid refractory material and then depositing the platinum or palladium.

Electrodes

IMPERIAL CHEMICAL INDUSTRIES LTD. *British Patent* 922,599

An electrode, e.g. for electrolytic purposes, is made by rolling into sheet from an intimate mixture of metal powders, i.e. at least 51% titanium or an alloy thereof, and a platinum group metal. The porosity of the mixture should not be more than 20 per cent.

Semiconductor Translating Devices

WESTERN ELECTRIC CO. INC. *British Patent* 922,617

A semiconductor signal translating device is made by forming a P-N junction in a single crystal silicon body, and heating the latter at a fixed temperature between 800° and 1300°C in the presence of gold or platinum long enough to allow uniform distribution of the noble metal throughout the body at a concentration level determined by the temperature.

Oxidising of Olefins

FARBWERKE HOECHST A.G. *British Patent* 922,694

A liquid catalyst comprising a salt of palladium, rhodium, ruthenium, iridium or palladium is used in a process for the manufacture of aldehydes, ketones and/or carboxylic acid by reaction of an olefin with oxygen.

4-hydroxy (and acyloxy)-3-Keto-steroids

SOC. FARMACEUTICI ITALIA *British Patent* 922,803

A 5-10% palladium-on-charcoal catalyst is used in a hydrogenation step in the preparation of the above compounds.

Production of Tetrachloropalladates

THE INTERNATIONAL NICKEL CO. (MOND) LTD. *British Patent* 922,838

Soluble metal tetrachloropalladate is made by reacting palladium metal with one molecular proportion of chlorine and with a metal chloride in aqueous solution.

Organic Compounds

SYNTEX S. A. *British Patent* 922,877

A palladium carbonate catalyst is used in a process of preparing an ester of a hydrocarbon carboxylic acid of given composition.

Production of Alkyl Pyridines

THE DISTILLERS CO. LTD. *British Patent* 923,347

A silica and/or alumina supported palladium catalyst is used in the production of alkylpyridines by heating a mixture of methacrolein acetaldehyde and ammonia at 300°C in the presence of the catalyst. See also No. 923,348.

Catalytic Oxidation Process

UNIVERSAL OIL PRODUCTS CO. *British Patent* 923,430

A platinum-alumina-halogen catalyst is used in a process for oxidation of hydrocarbon combustion products with added air at elevated temperature.

Preparation of Alkylated Phenolic Compounds

SHELL INTERNATIONALE RESEARCH MAATSCHAPPIJ N. V. *British Patent* 923,520

A platinum catalyst may be used in a process for preparing an alkylated phenolic compound.

Polymeric Compounds

COURTAULDS LTD. *British Patent* 923,584

A catalyst consisting of platinum on charcoal or hydrochloroplatinic acid is used in a process for making polymers by reacting an unsaturated derivative of 1,3,5-triazine and a diorgano tin or silicon compound of given general formulae.

Steroid Compounds

MERCK & CO. INC. *British Patent* 923,624

A platinum oxide catalyst is used in a process for preparing specified steroid compounds.

Production of Polycyclic Naphthene Concentrates

SOCONY MOBIL OIL CO. INC. *British Patent* 923,708

A platinum-alumina catalyst is used both for reforming and hydrogenation steps in a process of producing a jet fuel.

Organosilicon Compounds

IMPERIAL CHEMICAL INDUSTRIES LTD. *British Patent* 923,710

Organosilicon compounds are made by reacting together a silicon compound containing a silicon-bonded hydrogen atom and an unsaturated compound (defined) in the presence of a platinous salt and an olefin, e.g. platinous chloride and cyclohexene or ethylene.

Steroids

ROUSSEL-UCLAF *British Patent* 923,736

A platinum oxide catalyst is used in a hydrogenating step in the preparation of 17a-ethyl-11β, 17β-dehydroxy-$\Delta^{1,4}$androstadien-3-one. See also No. 923,737.

Decorating Ceramic Surfaces

L. REUSCHE & CO. *British Patent* 923,764

A non-porous vitreous ceramic surface is decorated by applying a film of a liquid bright gold preparation containing a rhodium compound and a compound of gold, platinum or palladium in the proportion of 100 parts gold, platinum or palladium to 0.45–5.68 parts of rhodium, and then applying a protective glass coating over this film.

Manufacture of of Pure Hexachlorodisilane

WACKER-CHEMIE G.m.b.H. *British Patent* 923,784

Very pure hexachlorodisilane is made by heating trichloromonosilane to 200°–600°C, cooling the reaction gases immediately to above 30°C and condensing the hexachlorodisilane. Heating may be effected by contact with hot bodies, which may consist of a platinum group metal or alloy.

D-Homo-Steroids

ROUSSEL-UCLAF *British Patent* 924,005, 924,006, 924,007

Refers to the use of a palladium hydrogenation catalyst in a process of preparing 18-nor-D-homo-13 α-androstane compounds.

Bursting Discs

ENGELHARD INDUSTRIES INC. *German Patent* 1,136,494

An alloy composed of 0.45% palladium, remainder gold, silver or platinum, of a purity of about 99.95% is used for making bursting discs having reproducible bursting characteristics.

Reduction of Halogen-Substituted Aromatic Nitro Compounds

E.I. DU PONT DE NEMOURS & CO. *U.S. Patent* 3,073,865

The formation of dehalogenated products during the catalytic hydrogenation of halogen-substituted benzenes and nitro naphthalenes to aromatic amines is reduced by carrying out the reduction in the presence of (1) a platinum-on-carbon catalyst as sole catalyst and (2) magnesium oxide or magnesium hydroxide at a temperature of 30°–120°C. The weight ratio of the nitro compound to the platinum is more than 10,000:1 but not more than 150,000:1.

Titanium Assemblies

IMPERIAL CHEMICAL INDUSTRIES LTD. *U.S. Patent* 3,074,858

An assembly in which there is electrical contact between titanium and graphite is made by depositing on the surface of the titanium, facing the graphite, a coating of a platinum metal and then contacting this coated surface with the graphite.

Production of Cyclohexanone

ALLIED CHEMICAL CORP. *U.S. Patent* 3,076,810

Cyclohexanone is produced by hydrogenating phenol by passing hydrogen in contact with phenol in the presence of a palladium catalyst promoted by sodium in amount of at least 1000 p.p.m., based on weight of catalyst, at super-atmospheric pressure and a temperature above 150° to 225°C.

Fuel Cell Electrode

UNION CARBIDE CORP. *U.S. Patent* 3,077,507

A fuel cell for direct conversion of an oxidising agent and an oxidisable fuel to electricity, and formed of two or more electrodes and an electrolyte, has at least one of the electrodes composed of an inert porous conductive substrate carrying a uniformly thin continuous coating of gas-permeable highly active carbon consisting of the disproportionation product of a gaseous carbonaceous atmosphere in the presence of a metal catalyst. The substrate may have a thin layer of silver and a platinum group metal may be applied over the active carbon.

Production of 5(4-amino-butyl)-hydantoin

E. I. DU PONT DE NEMOURS & CO. *U.S. Patent* 3,078,274

A catalyst of palladium or platinum may be used in producing a halovaleraldehyde semi-carbazine by hydrogenating 5-chlorovaleronitrile or 5-bromo-valeronitrile in the presence of semi-carbazide and the catalyst.

Hydroisomerisation Process

GULF RESEARCH & DEVELOPMENT CO. *U.S. Patent* 3,078,323

Use is made of a halogen-promoted supported platinum catalyst in a hydroisomerisation process.

Oxidation of Nitric Oxide

ENGELHARD INDUSTRIES INC. *U.S. Patent* 3,079,232

Nitric oxide is oxidised to nitrogen dioxide by contacting a nitric oxide and oxygen-containing gas (also containing water vapour) with a supported platinum, palladium, ruthenium or rhodium catalyst. The support may be activated alumina, pumice, silica gel, diatomaceous earth, asbestos, titanium dioxide, clay or calcium carbonate. Metal is present in amount of 0.1–2% by wt. of catalyst.

Conversion of Hydrocarbons

TEXACO INC. *U.S. Patent* 3,079,328

A hydrocarbon liquid boiling in the motor fuel range and containing *n*-hexane is converted by contacting it at 700°–750°F and at a pressure of 50–1000 p.s.i.g. in the presence of hydrogen with a catalyst composed of 0.5–6 wt.% of combined fluorine, 0.5–10 wt. % of boria and 0.1–1 wt.% of platinum supported on alumina. The catalyst is made by contacting a composite comprising platinum on alumina with boron trifluoride to cause reaction between the trifluoride and part of the alumina.

Hydrogenation of Nitrophenol

ABBOTT LABORATORIES *U.S. Patent* 3,079,435

Nitrophenol is hydrogenated by mixing the phenol, a catalyst of platinum, palladium or their oxides, at least one molar equivalent of an inert mineral acid or of acetic acid and water to form a mixture containing 10% or more nitrophenol and hydrogenating at a pressure below 100 p.s.i. with gaseous hydrogen until 3 moles of hydrogen are absorbed.