

DERWENT  
WORLD PATENTS INDEX

**The Derwent Classification**

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- *guard* against infringements of your patents
- *see* the extent to which an invention has been protected.



# Introduction

## How Derwent classifies and indexes patents

Derwent categorises patent documents using an easy to use classification system for all technologies. This unique system is consistently applied to all patents by Derwent's subject specialists, enabling you to search precisely and effectively in any area of technology.

This booklet provides a simple guide to the coverage of the Derwent classification system, and how it can help you. There are three basic subject areas – Chemical, Engineering and Electrical & Electronic. A description of the technology-based classes which are applied in each subject category is included in this booklet.

## The Derwent classification system

The Derwent classification system is hierarchical. This enables you to search for patents with subject groupings that are as broad or narrow as you need:

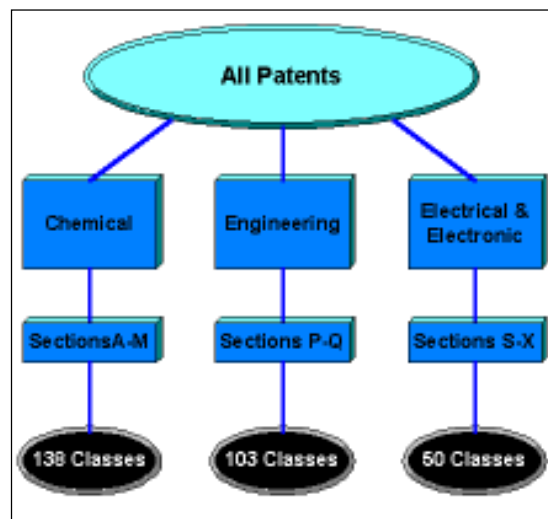
- Technology Groupings
- Sections
- Classes
- Manual Codes (Chemical and Electrical & Electronic)

We first categorise patents into three **Technology Groupings** – Chemical, Engineering or Electrical & Electronics. These three groups are then subdivided into 21 subject **Sections** – Chemical (Sections A-M),

Engineering (P-Q) and Electrical & Electronic (S-X). To enable more precise searching, Derwent splits each section into **Classes**. Each class is identified by the section letter, followed by two digits

### For example:

*X22 is the class for Automotive Electrics within Section X Electric Power Engineering. C04 is the class of all Chemical Fertilisers within Section C Agricultural Chemicals.*



*The Derwent classification system*

Each of the Electrical & Electronic and Chemical subject classes are further divided into sets of Manual Codes which are applied by Derwent's technical staff to allow detailed retrieval

## Derwent Classification and International Patent Classification (IPC)

The International Patent Classification (IPC) is an internationally-recognised classification system, controlled by the World Intellectual Property Organisation (WIPO). The IPCs are applied to patents by the national Patent Offices. All of the IPCs applied to a patent are included in the corresponding Derwent record, in addition to the Derwent classes and manual codes assigned by Derwent's subject specialists. In this booklet, the detailed descriptions of each section show how Derwent classes relate to the equivalent IPCs.

*Note: This IPC-Derwent class relationship is only a guide since Derwent classes are assigned intellectually by our subject specialists who evaluate each patent thoroughly. No strict correspondence between Derwent classes and IPCs is claimed. The only exception is in the Engineering sections (P and Q) where the correlation between IPCs and Derwent classes is exact.*

Before 1980, when we introduced the separate Electrical & Electronic classification (section S-X), a direct conversion of the IPC to Derwent class (section R) was used. Reference to R classes may be seen online, but can be ignored since all records have additional classes in the S-X sections which correspond to the R classes.

### Helping you to find the information you need

It should be noted that Patent Office classification schemes have been designed primarily to meet the needs of patent examiners and searchers concerned with intellectual property rights. As a result, patent office classifications may be only partially helpful for other searchers.

#### For example:

*In the chemical field, inventions classified by IPC are grouped by their chemical structure, not by their use. As a result, pharmacologically-active compounds may be intermingled with stabilisers for polymers or with herbicides.*

Another factor to be considered is that application of IPCs may vary between national Patent Offices for a number of reasons:

- There are often differences in national patent laws (e.g. with respect to non-obviousness) which will influence the finding needs of examiners and hence the classification policy of the office
- IPCs are not always consistently applied

#### For example:

*Washing machines are sometimes classified under IPC A47L (Domestic Appliances) and sometimes under IPC D06F (Laundering)*

- Frequently, not all of the relevant IPCs are applied

The Derwent Classification system does not have these limitations because:

- Derwent classes are consistently applied by our subject specialists according to a standard set of rules, irrespective of the patent origin
- Derwent emphasises both the Novelty and Use of the invention. Patent Offices are obliged by IPC convention to classify the inventive step information, with any additional information classified at their discretion
- Derwent subject specialists pay particular attention to ensure that borderline patents are included in the correct sections.

**For example:**

*A patent relating to a new organic chemical may be classified under IPC C07C (Organic Chemistry). However, if this new chemical can be used as a pharmaceutical intermediate, the Derwent Classification system will ensure that it is included in Section B (Pharmaceuticals).*

## Derwent patent family

Derwent's patent families bring together every patent relating to a single invention in one record, providing you with valuable information about the life of the invention.

We assemble patent family information starting with the first patent for a new invention that is processed by Derwent (the "Basic" patent). If the same invention is subsequently patented through another patent-issuing authority, we call this an "Equivalent". This grouping of Basics and Equivalents provides a valuable resource for tracking how an invention is protected by patents around the world.

Derwent is unique in that our patent families include non-convention patents which are not readily identifiable in other patent databases.

Since the national patent offices may apply IPCs in different ways, the same invention patented in a number of countries can have different IPCs. The Derwent patent family structure solves this problem by assigning the most appropriate Derwent class(es) to the Basic patent, after which all other members of the family (the Equivalents) automatically take the same course.

The only exception applies to Engineering patents where the classes applied to the Equivalent patent may be revised if the IPCs change.

## Maximise your search potential with Derwent classes

The use of Derwent classes in combination with other online search terms, for example a keyword search, gives you a simple and effective way to restrict your search to a specific subject area within a specific class.

**For example:**

*By searching Class X22 alone, you can find patents relating to all aspects of Automotive Electrics.*

*Using the word "warn" in a keyword search, you can find patents relating to a variety of warning devices, from personal security alarms to vehicle warning lights.*

*By combining Class X22 and the word "warn", you can restrict your search to patents which relate to automotive warning devices only.*

Derwent recognises that not all inventions fit neatly into one class. As a result, different classes are assigned to a patent as necessary to ensure that your searches retrieve all patents of interest.

**For example:**

*A patent about preparation of magnetic recording media for use in video tapes could be assigned to both the Chemical class L03 (section L, Refractories, Ceramics, Cements and Electro(in)organics) and the Electrical & Electronic class T03 Data Recording (section T, Computing and Control).*



# Chemical

## Sections

Chemical patents currently covered by Derwent are selected for inclusion in one or more of the following twelve sections.

- A Polymers and Plastics
- B Pharmaceuticals
- C Agricultural Chemicals
- D Food, Detergents, Water  
Treatment and Biotechnology
- E General Chemicals
- F Textiles and Paper-Making
- G Printing, Coating, Photographic
- H Petroleum
- J Chemical Engineering
- K Nucleonics, Explosives and  
Protection
- L Refractories, Ceramics,  
Cement and  
Electro(in)organics
- M Metallurgy

## Classes

These twelve Sections are broken down into 138 well-defined Classes. These are primarily intended to break down the subject matter simply and unambiguously for greater search precision.

Classification covers the complete patent document taking into account all the claims, particularly references to the use of chemicals or polymers, even when the main subject matter is non-chemical.

Where any patent specification falls logically into more than one section of the Chemical Classification it will be included in each of these Sections. Thus a patent involving a new dyestuff for polymeric fibres will be included in the appropriate classes of Sections A, E and F.

## A Polymers and Plastics

Patents that include the following features are selected for inclusion:

**Polymers:** Synthetic polymers. Selected natural polymers eg rubbers. Modified natural polymers. Polymerisation equipment and polymer work-up.

**Fabrication:** All processes and equipment for fabricating polymers including extrusion, injection moulding and slush moulding. The production, treatment and use of film, sheet and pipe.

**Monomers:** All patents relating to the production and purification of usefully polymerisable monomers, either known or shown clearly in the specification. Monomers are additionally covered in Section E.

**Additives:** Preparation and use of polymerisation catalysts. To be used in polymer processes. Stabilisers, surface-active agents, plasticisers, slip agents, antistatic agents etc for use with polymers

**Uses:** Wherever specific synthetic polymers or families of polymers are claimed or the specification is clearly concerned with them. Wherever novelty resides in the use of polymers. When the polymer is not specified or can be a range of alternative materials for an application it is not included. Thus the use of rubber (undefined) components for a common application would not be automatically included.

### A1 Addition and Natural Polymers

- A11 Polysaccharides; natural rubber; other natural polymers (*only a restricted range of (modified) natural polymers are included. Thus starch would be excluded, but chemically modified starch included*).
- A12 Polymers of di-and higher olefins; acetylenics; nitroso compounds.
- A13 Polymers of aromatic mono-olefins; including polystyrene.
- A14 Polymers of other substituted mono-olefins; including PVC, PTFE.
- A17 Polymers of unsubstituted aliphatic mono-olefins; including polyethylene.
- A18 Addition polymers in general.

### A2 Condensation Polymers

- A21 Epoxides; aminoplasts; phenoplasts.
- A23 Polyamides; polyesters. (*including polycarbonates, polyesteramides*); alkyds; other unsaturated polymers.
- A25 Polyurethanes; polyethers.
- A26 Other condensation polymers including silicone polymers and polyimides (*mineral silicates and similar materials would not usually appear in Section A*).
- A28 Condensation polymers in general.

### **A3 Processing: General Additives and Applications**

- A31 Preliminary processes.
- A32 Polymer fabrication - such as moulding, extrusion, forming, laminating, spinning.
- A35 Other processing and general - including vulcanisation, welding of plastics and adhesive processes. Testing.

### **A41 Monomers and Condensants**

These are also included in Section E.

### **A60 Additives and Compounding Agents**

If the usage is very restricted it may be classified under the individual polymer or process involved.

### **A8/9 Applications**

- A81 Adhesives and binders - including chipboard.
- A82 Coatings, impregnations, polishes - excluding textile finishing.
- A83 Clothing, footwear.
- A84 Household and office fittings - including carpets and carbon paper.
- A85 Electrical applications.
- A86 Fancy goods, games, sports, toys.
- A87 Textile auxiliaries.
- A88 Mechanical engineering and tools e.g. valves, gears and conveyor belts.
- A89 Photographic, laboratory equipment, optical - including electrophotographic, thermographic uses.

- A91 Ion-exchange resins, polyelectrolytes.
- A92 Packaging and containers - including ropes and nets.
- A93 Roads, building, construction flooring.
- A94 Semi-finished materials - fibres, films, foams.
- A95 Transport - including vehicle parts, tyres and armaments.
- A96 Medical, dental, veterinary, cosmetic.
- A97 Miscellaneous goods not specified elsewhere - including papermaking, gramophone records, detergents, food and oil well applications.

## B Pharmaceuticals

All patents stated to be of pharmaceutical or veterinary interest, as well as those relating to compounds for use as intermediates in the manufacture of pharmaceutical or veterinary products. Compositions used for diagnosis and analysis in the pharmaceutical and veterinary fields (e.g. stains for bacterial pathogens) are also included.

Artificial sweeteners, chemical warfare agents and plaque disclosing compositions are also included.

Patents dealing with the production of tablets, pills, capsules, suppositories etc. are included, as are devices for dispensing pharmaceuticals such as - syringes, child-proof closures, calendar pill boxes, aerosols etc.

For each compound where more than one of the classifications given below could be assigned, then the order of priority is B1 before B2, B2 before B3.

- B01 Steroids - including systems containing carbocyclic and/or heterocyclic rings fused onto the basic steroidal ring structure.
- B02 Fused ring heterocyclics.
- B03 Other heterocyclics.
- B04 Natural products and polymers. Including testing of body fluids (other than blood typing or cell counting), pharmaceuticals or veterinary compounds of unknown structure, testing of microorganisms for pathogenicity, testing of chemicals for mutagenicity or human toxicity and fermentative production of DNA or RNA. General compositions.

- B05 Other organics - aromatics, aliphatic, organo-metallics, compounds whose substituents vary such that they would be classified in several of B01 - B05.
- B06 Inorganics - including fluorides for toothpastes etc.
- B07 General - tablets, dispensers, catheters (excluding drainage and angioplasty), encapsulation etc, but not systems for administration of blood or saline or IV feeding etc.

## C Agricultural Chemicals

Patents covering compounds of agricultural and veterinary interest are included:

**Pest growth control agents:** Insecticides, miticides, rodenticides, molluscicides, slugicides, vermicides (nematocides, anthelmintics, etc.) soil fumigants, pest repellents and attractants. Biological control; microorganisms, predators and natural products.

**Plant growth control agents:** Herbicides, weedicides, defoliants, desiccants, fruit drop and set controllers, rooting compounds, sprouting inhibitors, growth stimulants and retardants, moss and lichen controllers. Plant genetics.

**Plant disease control agents:** Fungicides, viricides, timber preservatives and bactericides.

**Soil improvement agents:** Fertilisers, trace metal additives, bacterial action control stimulants and soil consolidation agents if for agricultural purposes.

**Veterinary products:** Disease control agents, nutritional agents, veterinary vaccines.

For each compound where more than one of the classifications given below could be assigned, then the order of priority is C01 before C02 and C02 before C03.

- C01 Organophosphorus; organometallic - i.e. compounds containing other than H, C, N, O, S and halogen.
- C02 Heterocyclic.
- C03 Other organic compounds, inorganic compounds and multi-component mixtures. Polymers and proteins.

- C04 Fertilisers - including urea and phosphoric acid production. Also soil modifiers and plant growth media. Chemical aspects of compost production.
- C05 Biological control - excluding veterinary medicine, but including use of microorganisms, predators and natural products.
- C06 Biotechnology - including plant genetics and veterinary vaccines.
- C07 Apparatus, formulation, general. including veterinary syringes, general formulations where the active compound is not central to the invention (e.g. wettable powders) and analysis.

## D Food, Detergents, Water Treatment and Biotechnology

The food Classes include all commercial food machinery, processes and products. Domestic apparatus, operations which would be performed on the farm or plantation prior to arrival at the food factory, and packaging are excluded.

*Approximate IPCs are given in brackets.*

### D1 Food and Fermentation

- D11 Baking - including bakery products, flour, doughs, bakery ovens, dough transporting and/or handling equipment, pies and pasta, but not flour milling (A21).
- D12 Butchering, meat treatment, processing poultry or fish (A22).
- D13 Other foodstuffs and treatment - including preservation of food, milk, milk products, butter substitutes, edible oils and fats, non-alcoholic beverages, artificial sweeteners, food additives and animal feed (A23B-L).
- D14 General foodstuffs machinery - excluding machines which can be classified in D11-13 (A23N, P).
- D15 Chemical or biological treatment of water, industrial waste and sewage - including purification, sterilising or testing water, scale prevention, treatment of sewage sludge, regeneration of active carbon which has been used for water treatment and impregnating water with gas e.g. CO<sub>2</sub>, but excluding plant and anti-pollution devices (C02).

- D16 Fermentation industry - including fermentation equipment, brewing, yeast production, production of pharmaceuticals and other chemicals by fermentation, microbiology, production of vaccines and antibodies, cell and tissue culture and genetic engineering.
- D17 Sugar and starch industry (C07H, C13).
- D18 Skins, hides, pelts, leather and chemical treatment of tobacco.

### D2 Cosmetics, Disinfectants and Detergents

- D21 Preparations for dental or toilet purposes - including filling alloys, compositions for dentures or dental impressions, anti-carries chewing gum, plaque disclosing compositions, toothpastes, cosmetics, shampoos, topical anti-sunburn compositions and toilet soaps (A61K).
- D22 Sterilising, bandages, dressing and skin-protection agents - including sterilising agents (other than for food), sutures, plaster casts, bioactive prostheses, contact lenses, diapers, animal litter, timber, preservatives, disinfectants, bactericidal detergents, deodorants, insect repellent compounds, moth proofers, sheep dip (A61L).
- D23 Oils, fats and waxes - including fatty acids, essential oils, but excluding butter (substitutes) and montan wax (C11B, C).
- D24 Soap (limited to metal salts of fatty acids which are used for cleaning) (C11D).
- D25 Detergents - other than soap and used for cleaning (C11D).

## E General Chemicals

Patents concerning the production, purification, use, detection, removal or phase changes, of non-polymeric chemical compounds, and apparatus or novel catalysts for producing them, are classified in Section E.

Exceptions to this are:

- Compounds stated to be solely for use as a pharmaceutical, veterinary medicament, fertiliser, herbicide or pesticide which are classified only in Sections B and/or C. However, where an additional use is stated, e.g. the compound is also a dyestuff intermediate, the patent is classified in Sections B and/or C and E.
- Monomers taking part in a polymerisation reaction and starting materials for a chemical reaction are not classified in Section E, unless the patent is also concerned with the production or purification of the monomer/starting material.
- Polymerisation catalysts are not normally classified in Section E, unless the novelty of the invention is the catalyst and it is a single compound.
- Mixtures of compounds described as a cut in petrochemical process are normally classified in Section H only.
- Highly complex non-stoichiometric compounds, e.g. those used as fluorescent materials are classified in Section L only, but simpler compounds are normally classified also in Section E. Growth of single crystals of pure elements or compounds e.g. Si, GaAs or BN is classified in Sections E and L.

Where necessary a patent is classified in Section E for the compound and other Section(s) for its use(s), etc. Typically, perfumes, flavourings and additives to foods and tobacco are normally classified in Sections D and E. Solvents and very common reagents such as water are not normally classified in Section E.

For each compound, when more than one of the classifications below could be assigned, then the priority is E11 before E12 and E12 before E13.

### E1 General Organic

- E11 Containing P and/or Si.
- E12 Organometallics - ie containing other than H, C, N, O, S, halogens, Si and P.
- E13 Heterocyclics.
- E14 Aromatics - i.e. containing at least one benzene ring.
- E15 Alicyclics.
- E16 Aliphatics - containing N and/or halogen.
- E17 Other aliphatics.
- E18 General hydrocarbon mixtures.
- E19 Other organic compounds general - organic compounds of unknown or indefinite structure; general mixtures of many types; organic reactions (e.g. nitration, resolution) when applied generally.

### E2 Dyestuffs

- E21 Azo - including diazonium compounds.
- E22 Anthracene - including those containing more than 3 rings.
- E23 Heterocyclic.
- E24 Other dyes, all precursors.
- E25 General and other dyes

E26 Dye precursors excluding E21-E, E24-B

E27 Dye formulations; morphology

### **E3 General Inorganic**

E31 Compounds of V, Nb, Ta, Cr, Mo, W, Mn, Tc, Re, Fe, Ru, Os, Co, Rh, Ir, Ni, Pd, Pt, Pa, U and subsequent actinides.

E32 Compounds of Ti, Zr, Hf, Cu, Ag, Au, Zn, Cd, Hg, Ga, In, Te, Ge, Sn, Pb, As, Sb, Bi.

E33 Compounds of Be, Mg, Ca, Sr, Ba, Ra, Sc, Y, La, Ac, Al, lanthanides (Rare-earths), Th.

E34 Compounds of Li, Na, K, Rb, Cs, Fr.

E35 Ammonia, cyanogen and their compounds - including HCN and cyanamide, but not hydrazine.

E36 Non-metallic elements, semi-metals (Se, Te, B, Si) and their compounds (except for E35).

E37 Mixtures of many components; inorganic reactions and processes of general applicability.

## F Textiles and Paper-Making

Patents classified in this section include all aspects of clothing, as well as all textile machinery.

Non-textile fibre handling processes are excluded eg for fibre-reinforced polymer production are classified only in Section A.

*Approximate IPCs are given in brackets.*

- F01 Threads and fibres - natural or artificial; spinning - including the production of mineral and carbon fibres (D01).
- F02 Yarns - mechanical finishing of yarns or ropes; warping or beaming (D02, D07).
- F03 Weaving - including finished products (D03).
- F04 Braiding, knitting - including trimmings and non-woven fabrics (D04).
- F05 Sewing, embroidering, tufting - including finished products (D05).
- F06 Chemical-type treatment of textiles (D06B, L, M, P, Q).
- F07 Other textile applications - include mechanical treatment of fabrics (D06C, F, G, H, J, L, M).
- F08 Flexible sheet materials - consisting of polymer-coated fibrous web, including end products not classified in other sections (D06N).
- F09 Paper-making production of cellulose, chemical treatment of wood - including chipboard and fibre-board (D21).

## G Printing, Coating, and Photographic

Specifications with no chemical interest are not included. Thus printing machines and photographic film processing apparatus and adhesive applicators are excluded.

Adhesive processes in the production of specific goods are excluded, unless the novelty lies in the adhesive material.

Normally excluded from Section G are polymeric coatings produced by hot melt extrusion e.g. cable coatings (Section A), metallic coatings (Section M) and vitreous enamel coatings (Section L).

Fillers for specific materials are usually classified under the related material section, e.g. Section A, and are excluded from Section G.

*Approximate IPCs are given in brackets.*

- G01 Inorganic pigments and non-fibrous fillers (C09C).
- G02 Inks, paints, polishes – polymer-based paints and inks are also classified in Section A (C09D, F, G).
- G03 Adhesives - excluding dispensers. Polymeric adhesives are also classified in Section A (C09H, J).
- G04 Miscellaneous compositions - including luminescent and tenebrescent materials, de-icing/de-misting compositions, mastics, heat transfer compositions and aerosol-can filling mixtures (C09H).
- G05 Printing materials and processes (B41, M, N).
- G06 Photosensitive compositions and bases; photographic processes - includes photoresist coatings (G03C).
- G07 Photo-mechanical production of printing surfaces (G03F).
- G08 Electrography, electrophotography and magnetography (G03G).

## H Petroleum

Comprehensive coverage of all aspects of the oil and gas industry with limited coverage of competitive products e.g. coal and peat.

*Approximate IPCs are given in brackets*

- H01 Obtaining crude oil and natural gas - including exploration, drilling, well completion, production and treatment. General off-shore platform and drilling technology is included together with the treatment of tar sands and oil shales (C10G, E21B).
- H02 Unit operations - including distillation, sorption and solvent extraction (C10G).
- H03 Transportation and storage - only large scale systems are included. Road tankers and retail petrol station-type applications are excluded. Treatment of pollution from marine oil tankers is included.
- H04 Petroleum processing - including treating, cracking, reforming, gasoline preparation - biosynthesis based on hydrocarbon feedstocks is included (C10G).
- H05 Refinery engineering.
- H06 Gaseous and liquid fuels - including pollution control. Chemical aspects of catalytic exhaust systems for cars are included as well as liquid or gaseous fuels of non-petroleum origin e.g. methanol or ethanol-based fuels. Combustion improvement additives for liquid fuels are included (C10L).
- H07 Lubricants and lubrication - this excludes self-lubricating surfaces e.g. PTFE coated surfaces and lubrication systems in general. The section includes lubricants of non-petroleum origin eg silicone oils (C10M).
- H08 Petroleum products, other than fuels and lubricants - this includes hydraulic fluids and electrical oils even when of non-petroleum origin (C10M).
- H09 Fuel products not of petroleum origin - excluding coal handling, preparation or mining, but including coking, briquetting, peat processing synthesis, gas production, coal gasification. Combustion improvement additives for coal, peat and other non-hydrocarbon based fuels are included in this Section together with coal liquefaction and desulphurisation.

## J Chemical Engineering

Unit processes and/or plant for *general application in chemical industries* are included in this section, but processes and apparatus for specific applications are excluded.

*Approximate IPCs are given in brackets.*

- J01 Separation - including evaporation, crystallisation, solvent extraction, chromatography, dialysis, osmosis including drying gases and/or vapours, and separation of solids from gases, liquids and other solids. Isotope separation, filter materials (including molecular sieves for separation), and centrifuges (except where used for analysis) (B01D, B03, B04, B07B).
- J02 Mixing and including dispersing (B01F).
- J03 Electrochemical processes and electrophoresis - including ozone production, brine electrolysis, water electrolysis, production of chemical compounds and non-metallic elements, but excluding batteries or other means of producing power and the treatment of metals (C25B).
- J04 Chemical/physical processes/apparatus - including catalysis, catalysts (excluding specific e.g. enzymatic or polymerisation catalysts), colloid chemistry, laboratory apparatus and methods, testing, controlling, general encapsulation, detection and sampling (excluding clinical testing) (B01J, L).
- J05 Boiling and boiling apparatus - including generation of steam unless for power plant (B01B).
- J06 Storing or distributing gases or liquids - including gas holders, vessels for gases, decantation and vaporisation of gases, pipelines and pipe systems, but excluding those for hydrocarbon gases or liquids and laying of pipelines (F17).
- J07 Refrigeration; ice; gas liquefaction/solidification - including machines, freezing of (semi)liquids, gas separation/liquefaction by cooling or pressure, fractionation of air (F25).
- J08 Heat transfer and drying - including direct/indirect heat exchangers, heat transfer apparatus, drying processes (F26, F28).
- J09 Furnaces, kilns, ovens, retorts including furnace constructional details and accessories, but only where of general application (F27).

## **K Nucleonics, Explosives and Protection**

All aspects of the nuclear industry, chemical aspects of fire fighting, explosives and warfare agents.

*Approximate IPCs are given in brackets.*

- K01 Fire fighting, fire-extinguishing compositions - excluding fire engines, sprinkler systems, hose reels and protective clothing (A62D with K2).
- K02 Protection against chemical warfare breathing apparatus - chemical aspects only (A62D with K1).
- K03 Explosive charges; ammunition, fuses, blasting including only complete devices, except missile systems (F42).
- K04 Explosives, matches - including detonators, chemical lighters, pyrophoric compositions, fire works, distress signals, chemical lasers, smoke generation, gas attack compositions, generation of gas for blasting or propulsion but only their chemical aspects (C06).
- K05 Nuclear reactors and simulators - including reactor processes, components and accessories, but excluding power plant (G21B, C).
- K06 Nuclear power plant - including reprocessing used nuclear fuel (G21D).
- K07 Health physics - including radiation protection (other than against sunlight), monitoring devices, decontamination, radioactive waste disposal and protective clothing (G21F).

- K08 Nucleonics; X-ray techniques - including conversion of chemical elements, nuclear explosives and plasma techniques other than electron beam or plasma welding methods and apparatus and X-ray films (G01T, G21G, H, J, K, H05G, H).

## L Refractories, Ceramics, Cement and Electro(in) Organics

Comprehensive coverage of glass and ceramic compositions combined with chemical aspects of electronic devices and optical fibres.

*Approximate IPCs are given in brackets.*

- L01 Glass - includes chemical compositions, batch treatment, furnaces, flat glass forming, hollow-ware forming, post-forming and glass/ceramics, but not lens designs, bottling, bottle-washing, closures for containers, glazing designs, glass cutting, chamfering edges, printing on glass, disposing of used glass or the production of pure sodium silicate. Chemical aspects of optical fibres (C03).
- L02 Refractories, ceramics, cement - includes manufacturing methods, limes, soil preparation for (road) building, magnesias and slags, cements, mortars, concretes, abrasives, thermal or acoustic insulation (non)oxide ceramics and ceramic composites, but not brick making, concrete mixers or casting or potters' wheels (C04).
- L03 Electro-(in)organic - chemical features of conductors, resistors, magnets, capacitors and switches, electric discharge lamps, semiconductor and other materials, batteries, accumulators and thermo-electric devices, including fuel cells, magnetic recording media, radiation emission devices, liquid crystals and basic electric elements. Growing of single crystals of semiconductors and their doping are included, but semiconductor devices, where the manufacture is not claimed are excluded. Electrography, electrophotography, magnetography, electrolysis, electrophoresis, power plant,

X-ray and plasma-techniques, ion-exchange resins, polyelectrolytes, electroplating, metal electrodeposition, electroforming, anodising, electrolytic cleaning, cathodic protection and electrolytic or electrothermic production or refining of metals are all covered elsewhere (Sections G, J, K and M).

## **M Metallurgy**

Chemical aspects of metal production, working and finishing including welding and brazing.

*Approximate IPCs are given in brackets.*

### **M1 Metal Finishing**

- M11 Electroplating; electrolytic treatment of or with metals - including electro-deposition of metals, electro-plating apparatus, electro-forming, electro-erosion, spark erosion, anodising (electrophoretically) coating metals and electrolytic cleaning and polishing (C25).
- M12 Chemical cleaning and degreasing - including cleaning and pickling.
- M13 Coating material with metals, diffusion processes, enamelling and vitreous coatings - including coating from liquid metal or solution, spraying, cementation, cathodic sputtering, enamelling and oil-free lubricant coatings, but not coatings for the production of semiconductors (C23C, D).
- M14 Other chemical surface treatments - including etching, brightening, forming non-metallic layers, passivation, cathodic protection and corrosion inhibitors, but not processes specifically for semiconductor production (C23F, C25). This Section also covers multistage processes.

### **M2 Metals**

- M21 Metal rolling and forming (B21).
- M22 Casting; powder metallurgy - including foundry moulding, moulding machines, patterns, moulds, cores and metal casting (B22).

- M23 Soldering; welding - including brazing, flame cutting and scarfing, cutting and welding rods, soldering and unsoldering apparatus and solder compositions (B23K).
- M24 Metallurgy of iron and steel - including manufacture and processing, treatment of steel melts and changing the physical properties of iron and steel, control/testing methods, blast furnaces and converters. Metallurgical coking processes (C21, C10B).
- M25 Production and refining of metals other than iron - including ore treatment, extraction, working up scrap, obtaining specific metals, control testing methods (C22B).
- M26 Non-ferrous alloys - including alloy production and composition (C22C).
- M27 Ferrous alloys - including alloy production and composition (C22C).
- M28 Electrolytic and electrothermic production and refining of non-ferrous metals - excluding heat treatment (C25).
- M29 Changing the physical structure of non-ferrous metals and alloys - including tempering, annealing, work-hardening and recrystallising (C22F).



# Engineering

## Sections

Engineering patents currently covered by Derwent are selected for inclusion in one or more of the following 15 sections based upon the International Patents Classification (IPC) shown in brackets.

### P General

- P1 Agriculture, Food, Tobacco (A01 excluding N, A24).
- P2 Personal, Domestic (A41-A47).
- P3 Health, Amusement (A61-A63, excluding A61K).
- P4 Separating, Mixing (B02-B09).
- P5 Shaping Metal (B21-B23).
- P6 Shaping Non-metal (B24-B28).
- P7 Pressing, Printing (B30- B32, B41-B44).
- P8 Optics, Photography; General (G02, G03, G09, G10).

### Q Mechanical

- Q1 Vehicles in General (B60).
- Q2 Special Vehicles (B61-B64).
- Q3 Conveying, Packaging, Storing (B65-B68).
- Q4 Buildings, Construction (E).
- Q5 Engines, Pumps (F01-F15)
- Q6 Engineering Elements (F16-17).
- Q7 Lighting, Heating (F21-F28, F41-F42).

## Classes

These 15 Sections are broken down into 103 IPC-based Sub-Classes so as to narrow the subject matter into more detailed profiles for greater precision.

Classification is made automatically based on the IPCs assigned to the specification or, where not present (as for the Research Disclosure items), on the basis of Derwent-assigned IPCs.

Where a patent falls into more than one of the Sections P or Q, it will be placed in each. Engineering patents may also occur in one or more of the Chemical Sections (A-M) or Electrical and Electronic Sections (S-X).

*Note: Unlike the Chemical Classification, an equivalent may introduce a new P or Q Class (which is then added to the master record), if an IPC which is outside the range of those covered by the Classes already assigned to the patent family, has been applied to the equivalent.*

## P General

Human necessities, performing operations - all IPC A, excluding A01N, A21, A23, A61K; All IPC B02-B44, excluding B29. All IPC G02, G03, G09, G10.

*The IPCs are given in brackets.*

### P1 Agriculture, Food, Tobacco

- P11 Soil working, planting (A01B, C).
- P12 Harvesting (A01D, F).
- P13 Plant culture, dairy products (A01G, H, J).
- P14 Animal care (A01K, L, M).
- P15 Tobacco (A24).

### P2 Personal, Domestic

- P21 Wearing apparel (A41, A42).
- P22 Footwear (A43).
- P23 Haberdashery, jewellery (A44).
- P24 Hand, travelling articles, brushes (A45, A46).
- P25 Office furniture (A47B).
- P26 Chairs, sofas, beds (A47C, D).
- P27 Shop, household, furnishings (A47F, G, H).
- P28 Kitchen, sanitary equipment (A47J, K, L).

### P3 Health, Amusement

- P31 Diagnosis, surgery (A61B).
- P32 Dentistry, bandages, veterinary, prosthesis (A61C, D, F).
- P33 Medical aids, oral administration (A61G, H, J).

P34 Sterilising, syringes, electrotherapy (A61L, M, N).

P35 Life-saving, fire-fighting (A62).

P36 Sports, games, toys (A63).

### P4 Separating, Mixing

- P41 Crushing: centrifuging, separating solids (B02, B03, B04).
- P42 Spraying, atomising (B05).
- P43 Sorting, cleaning, waste disposal (B06, B07, B08, B09).

### P5 Shaping Metal

- P51 Rolling, drawing, extruding (B21B, C).
- P52 Metal punching, working, forging (B21D-L).
- P53 Metal casting, powder metallurgy (B22).
- P54 Metal milling, machining, electroworking (B23B-H).
- P55 Soldering, welding metal (B23K).
- P56 Machine tools (B23P,Q).

### P6 Shaping Non-Metal

- P61 Grinding, polishing (B24).
- P62 Hand tools, cutting (B25, B26).
- P63 Working, preserving wood (B27).
- P64 Working cement, clay, stone (B28).

### P7 Pressing, Printing

- P71 Presses (B30).
- P72 Working paper (B31).
- P73 Layered products (B32).
- P74 Printing: lining machines (B41B-G).

- P75 Typewriters, stamps, duplicators (B41J-N).
- P76 Books, special printed matter (B42).
- P77 Writing, drawing appliances (B43).
- P78 Decorative art (B44).

## **P8 Optics, Photography, General**

- P81 Optics (G02).
- P82 Photographic apparatus (G03B).
- P83 Photographic processes, compositions (G03C).
- P84 Other photographic (G03D-H).
- P85 Education, cryptography, adverts. (G09).
- P86 Musical instruments, acoustics (G10).

## Q Mechanical

Mechanical Engineering - all IPC B60-B68, E and F.

The IPCs are given in brackets.

### Q1 Vehicles in General

- Q11 Wheels, tyres, connections (B60B-F).
- Q12 Suspension, heating, doors, screens (B60G-J).
- Q13 Transmissions, controls (B60K).
- Q14 Electric propulsion, seating (B60L-N).
- Q15 Transporting special loads (B60P).
- Q16 Vehicle lighting, signalling (B60Q).
- Q17 Vehicle parts, fittings, servicing (B60R,S).
- Q18 Brake-control systems (B60T).
- Q19 Air-cushion vehicles (B60V).

### Q2 Special Vehicles

- Q21 Railways (B61).
- Q22 Hand, motor vehicles (B62B-D).
- Q23 Cycles (B62H-M).
- Q24 Ships (B63).
- Q25 Aircraft, aviation, cosmonautics (B64).

### Q3 Conveying, Packaging, Storing

- Q31 Packaging, labelling (B65B, C).
- Q32 Containers (B65 D01-37).
- Q33 Closures (B65 D39-55).
- Q34 Packaging elements, types (B65D57-91).

- Q35 Refuse collection, conveyors (B65F, G).
- Q36 Handling thin materials (B65H).
- Q37 Container traffic (pre-1984 only) (B65H).
- Q38 Hoisting, lifting, hauling (B66).
- Q39 Liquid, handling, saddlery, upholstery (B67, B68).

### Q4 Buildings, Construction

- Q41 Road, rail, bridge construction (E01).
- Q42 Hydraulic engineering, sewerage (E02, E03).
- Q43 General building constructions (E04B).
- Q44 Structural elements (E04C).
- Q45 Roofing, stairs, floors (E04D, F).
- Q46 Building aids, special structures (E04G, H).
- Q47 Locks, window and door fittings (E05).
- Q48 Blinds, shutters, ladders, doors (E06).
- Q49 Mining (E21).

### Q5 Engines, pumps

- Q51 Machines, engines in general (F01).
- Q52 Combustion engines, gas turbines (F02B-G).
- Q53 Jet engines, fuel supply (F02K, M).
- Q54 Starting, ignition (F02N, P).
- Q55 Machines, engines for liquids (F03).
- Q56 Pumps (F04).
- Q57 Fluid-pressure actuators (F15).

## **Q6 Engineering Elements**

- Q61 Securing machine parts together (F16B).
- Q62 Shafts, bearings (F16C).
- Q63 Couplings, clutches, brakes, springs (F16D, F).
- Q64 Belts, chains, gearing (F16G, H).
- Q65 Pistons, cylinders, packing (F16J).
- Q66 Valves, taps, cocks (F16K).
- Q67 Pipes, joints, fittings (F16L).
- Q68 Other engineering elements (F16M-T).
- Q69 Storing/distributing gas/liquid (F17).

## **Q7 Lighting, Heating**

- Q71 Lighting (F21).
- Q72 Steam generation (F22).
- Q73 Combustion equipment/processes (F23).
- Q74 Heating, ranges, ventilating (F24).
- Q75 Refrigeration, liquefaction (F25).
- Q76 Drying (F26).
- Q77 Furnaces, kilns, ovens, retorts (F27).
- Q78 Heat exchange in general (F28).
- Q79 Weapons, ammunition, blasting (F41-2).



# Electrical and Electronic

## Sections

Electrical and electronics patents covered by Derwent are selected for inclusion in one or more of the following 6 Sections:

- S Instrumentation, Measuring and Testing
- T Computing and Control
- U Semiconductors and Electronic Circuitry
- V Electronic Components
- W Communications
- X Electric Power Engineering

## Classes

These 6 Sections are broken down into 50 Classes. These Classes are assigned by Derwent according to the technical content as disclosed in the basic specification and take into account all the claims, particularly references to electrical applications, even when the main subject matter is chemical or mechanical in nature.

Where any patent specification falls logically into more than one Section of the Electrical & Electronic Classification it will be included in each of these Sections. Thus a patent involving a TV receiver line output transformer will be included in Classes V02 (Inductors and Transformers) and W03 (TV and Broadcast Radio Receivers).

Classes are not intended to serve as an indexing or retrieval tool, but to break down the subject matter simply and unambiguously into a number of profiles for greater precision.

Basic documents are selected for inclusion in the Electrical & Electronic Classification based mainly on their relevance to electronic and electrical industries. This means, for example that documents bearing the following IPCs are normally included: A61N, B60L, B60M, G01, G02F, G03G, G04, G05 (not G05G), G06, G07, G08, G09G, G10H, G11, G12, G21B and all IPC H.

In addition, we manually select from all other basics and include those of relevance to the electrical/electronic industries irrespective of assigned IPC.

*Note: All equivalents are regarded as falling within the same classes of Sections S-X as the parent document.*

Approximate IPCs are given in brackets.

## **S Instrumentation, Measuring and Testing**

Includes electrical aspects of medical equipment, photographic and printing apparatus

### **S01 Electrical Instruments**

Measuring magnetic and electrical variables. Instrument panels, housings, indicating elements, screening, suspensions, damping. Cooling arrangements. (G01R, G12B)

### **S02 Engineering Instrumentation**

Measuring dimensions, weight, flow rate, mechanical vibrations, force, acceleration, etc. Recording equipment. General testing methods. (G01B-H, L, M, P)

### **S03 Scientific Instrumentation**

Photometry, calorimetry. Thermometers. Meteorology, geophysics, measurement of nuclear or X-radiation. Investigating chemical or physical properties. (G01J, K, N, T-W)

### **S04 Clocks and Timers**

Electronic and mechanical clocks and watches. Time switches. Time-interval measuring. (G04B-G)

### **S05 Electrical Medical Equipment**

Electrotherapy. Electrosurgical apparatus. Blood cell counters. Electrical diagnostic apparatus. Tomography. Veterinary apparatus. (A61, A61N)

### **S06 Electrophotography and Photography**

Cameras, film projectors and film processing (electrical aspects only). Electrography, xerography. Rotary press printers (electrical aspects only). (G03, G03G)

## **T Computing and Control**

Covers control systems, data recording equipment, computing devices and peripheral apparatus, including construction details.

### **T01 Digital Computers**

Input/output arrangements and interfaces, data conversion and handling, e.g. arithmetic functions. Program control and systems software e.g. program and instruction execution, operating systems, etc. Error detection and correction, computer system architecture and data transfer. Distributed computing and computer networks. Computer applications. (G06C-F, G06T)

### **T02 Analogue and Hybrid Computers**

Function evaluators, equation solvers, simulators. (G06G, J)

### **T03 Data Recording**

Dynamic recording systems, i.e. based on relative movement between record carrier and transducer. Analogue and digital recording on tape, disc etc, using for example, magnetic, optical, magneto-optical, capacitive methods. (G11B)

### **T04 Computer Peripheral Equipment**

Card and tape punches and readers. Magnetic, optical and smart cards. Serial and line printers. VDUs, character and graphics generators. Pattern recognition, magnetic ink recognition, bar coders. COM equipment. (G06K)

### **T05 Counting, Checking, Vending, ATM and POS Systems**

Counting systems. Ticket issuing, registering and franking apparatus. Attendance registering apparatus. Coin and paper currency handling. Point-of-sale equipment. Electronic funds transfer. (G06M, G07B-G)

### **T06 Process and Machine Control**

General control systems. Control of non-electrical variables e.g. temporal flow. Control system applications e.g. machine tools, lifts. (G05B, D)

### **T07 Traffic Control Systems**

Traffic light systems, flow control. Electronic indicators. (G08G)

## U Semiconductors and Electronic Circuitry

Includes semiconductor components *per se*, their manufacture and circuitry. Circuits using electronic components are included, e.g. filters and oscillators.

### U11 Semiconductor Materials and Processes

Materials, substrate and layer processing, packages and mountings, assembly, testing, and handling aspects of all semiconductor devices, included in U12, U13, U14. Aspects of manufacture specific to devices such as LEDs, lasers, solar cells and especially thick film and hybrid circuits are covered in U12 and U14. (C30B, H01L)

### U12 Discrete Devices

Individual semiconductor devices, as either discrete components or specific parts of integrated circuit. Examples are LEDs, including LED arrays, semiconductor lasers, photovoltaic cells and arrays, discrete photodetectors, semiconductor transducers, diodes, capacitors, bipolar transistors, thyristors, unipolar transistors eg. FET, HEMT, and quantum interference devices. Also, defines specific application of inventions in U11. (H01L)

### U13 Integrated Circuits

Integrated circuit structures e.g., CMOS, BICMOS, optoelectronic IC, wafer scale integration. Analogue circuits. Digital circuits, especially with matrix arrays e.g. memory, programmable logic and gate arrays. Solid state image sensors e.g. CCD. Not used for routinely integrated

circuitry e.g. logic gates, or for IC application which do not claim actual IC novelty. (H01L)

### U14 Memories, Film and Hybrid Circuits

Digital memories including magnetic, optical, semiconductor, ferroelectric analog memories. Testing of memories. Thermoelectric devices. Superconductive materials and devices. Acoustic wave devices. Thin film arrays and layers. Thick film and hybrid circuits including multilayer ceramic wiring boards. Electroluminescent light sources. Passive displays, especially liquid crystal displays. (G11C, H01L)

### U21 Logic Circuits, Electronic Switching and Coding

Basic logic circuits, eg AND-gates. A/D and D/A conversion. Delta modulation, coding, code conversion, error detection and correction. Pulse counters, frequency conversion. Electronic switching circuits. (H03K, M)

### U22 Pulse Generation and Manipulation

Rectangular wave oscillators, pulse generators, (astable, bistable, etc). Pulse shapers. Digital waveform synthesizers. PAM, PPM, PFM, PDM (modulation and demodulation aspects). Digital filters. DSP. (H03K, L)

### U23 Oscillation and Modulation

Oscillators, mixers. Amplitude and angle (de)modulation. Frequency and phase comparators. PLLs. (H03B-D, H03L)

## **U24 Amplifiers and Low Power Supplies**

DC, LF and HF amplifiers, parametric, magnetic, dielectric amplifiers. Gain control. Volume compression or expansion. Limiters. Voltage and current stabilisation, power supplies, converters, inverters, rectifiers. Low power protection. (H03F, H03G, G05F, H02M)

## **U25 Impedance Networks and Tuning**

Tone or bandwidth control. Impedance converters. Analogue filters (active and passive). Voltage dividers, attenuators, impedance matching, baluns. Tuning circuits. AFC. (H03H, H03J)

## V Electronic Components

Includes electrical and electro-optical components. Component mounting and construction details. Electrical discharge devices for non-lighting applications are included.

### V01 Resistors and Capacitors

Low power fixed and variable devices. Thermistors. VDRs. Electrolytic and non-electrolytic capacitors. (H01C, G)

### V02 Inductors and Transformers

Low power inductive components. Communication type inductive components. (Electro)magnets. (H01F)

### V03 Switches, Relays

Low power switches and relays. Thermally or magnetically operated switches. (H01H)

### V04 Printed Circuits and Connectors

PCBs and their manufacture. Low power connectors. Electronic apparatus, housings and constructional details. RFI/EMI screening. General circuit manufacture. (H01R, H05K)

### V05 Valves, Discharge Tubes and CRTs

Vacuum tubes, klystrons, TWTs, magnetrons, CRTs, camera tubes, X-ray tubes and operating circuits. Photoelectric discharge tubes. Gas filled tubes. Gas discharge displays. (H01J, H05G)

### V06 Electromechanical Transducers and Small Machines

Audio-communication - and measurement type transducers. Electromechanical resonators. Small electric machines and their controllers. (H04R, H03H, H02K)

### V07 Fibre-optics and Light Control

Light guides. Connectors, couplers, mode selectors, polarisers. Switching, gating, modulating etc. (G02B, F)

### V08 Lasers and Masers

Components for and types of laser and maser devices. Pumping and mode locking circuitry. (H01S)

## W Communications

Covers telecommunications, audio and video equipment, telemetry/telecontrol and radar, aviation, marine and military systems where electrical details are included.

### W01 Telephone and Data Transmission Systems

Error detection and correction. Code conversion. Synchronising. Secret data communication. Data networks (LAN, WAN, etc). ISDN. Baseband and broadband data transmission. Exchanges, call metering, test equipment, equipment racks. Subscriber equipment, cordless and cellular phones. Telephone line and cable installation. (H04L, M, Q)

### W02 Broadcasting, Radio and Line Transmission Systems

Aerials, waveguides, resonators and other distributed constant components. Transmitters, transceivers, transponders. Communication receivers. Line transmission systems. Radio systems, including diversity, relay, mobile (including cellular). Optical and ultrasonic wave transmission systems. Spread Spectrum communication. Secret communication, jamming. Facsimile. TV systems, including colour, stereoscopic, cable, subscription, satellite and high definition. Stereophonic broadcast systems. (H01P, Q, H04, H04K)

### W03 TV and Broadcast Radio Receivers

AM/FM/SW radio receivers, car radios. TV receivers. Teletext, high definition, satellite, stereophonic. Remote control. Audio amplifiers. AV systems and interconnection. (H04)

### W04 Audio/Video Recording and Systems

Loudspeaker enclosures, cross-over networks. Audio disc recording and reproducing equipment. Audio magnetic tape recording and reproduction. Sound mixers. Electrical musical instruments. Video cameras, camera recorders, electronic still-picture cameras. Studio equipment e.g video mixers, special effect apparatus. Projection TV. Video tape and disc recording and reproduction. Video games, karaoke. Electronic educational apparatus. Sports equipment. Speech coding, analysis and synthesis. Antiphase sound cancelling. (G10H, G11B, H04N)

### W05 Alarms, Signalling, Telemetry and Telecontrol

Burglar and fire alarms. Personal calling arrangements. Paging systems. Signal transmission systems for remote control and monitoring e.g. in home bus systems, vehicle remote control bus systems. Advertising arrangements (electrical aspects). (G08B, C)

### W06 Aviation, Marine and Radar Systems

Radar, sonar and lidar. Velocity and depth measuring equipment. Airport control systems. Ship and aircraft control and instrumentation. Flight simulators. Space vehicles, including satellites. (G01S)

### W07 Electrical Military Equipment and Weapons

Target indicating systems. Sighting devices. Missile direction control. Military training equipment. Arming and safety devices. (F41)

## X Electric Power Engineering

Includes power generation, storage and distribution and electrical details for ground vehicles. Patents for industrial equipment having significant electrical detail are also included. Patents relating to domestic electrical appliances need not contain electrical novelty to be included.

### X11 Power Generation and High Power Machines

Conventional power generating prime movers. Dynamo-electric machines. MHD generators. (H02K, N)

### X12 Power Distribution/ Components/Converters

High power AC, DC and HVDC distribution/control. Power and communication cables. Superconducting cables, coils and magnets. Installing power cables and lines. Power transformers, reactors. Spark gaps and circuits. Insulators. High power connectors. Power converters. Conductive, superconductive and insulating materials. (H01B, H01T, H02G, H02J, H02M)

### X13 Switchgear, Protection, Electric Drives

Electric machines and static power converters. Controllers. Switchboards, switchyards, switchgear. Power system protection. Circuit protectors, circuit breakers, fuses. (H02B, H02H, H02P)

### X14 Nuclear Power Generation

Nuclear reactor processes, components and power plants. Control mechanisms. Plasma techniques Particle accelerators. (G21, H05H)

### X15 Non-Fossil Fuel Power Generating Systems

Geothermal, wind, wave and solar energy, types of power generation. (F03D, F24J)

### X16 Electrochemical Storage

Primary, secondary and fuel cells and batteries. Battery chargers. Non-electrochemical storage of electric energy. (H01M)

### X21 Electric Vehicles

Electric cars, trolley buses. Propulsion, braking. Power supply lines, current collectors. Traction batteries. Control equipment. (B60L)

### X22 Automotive Electrics

Vehicle accessories. Vehicle lighting. IC engine ignition. IC engine controllers. Batteries and charging. Starting motors, and generators. Engine and vehicle instrumentation. Non-engine related controllers e.g. transmissions, brakes. (F02P, F02D, F02M, F02N, F21M, B60K, B60Q, B60R, B60T)

### X23 Electric Railways and Signalling

Propulsion, power and distribution, signalling, control. (B60L, B61L)

## **X24 Electric Welding**

Electric soldering. Arc, induction, electron beam, resistance, laser beam and HF welding. Electroerosion. (B23K)

## **X25 Industrial Electric Equipment**

Electric furnaces and kilns. Resistance, induction, electric discharge and EM field heating. Electrostatic spraying and cleaning. Vibrating apparatus. Electrolytic processes. Electro-refining metals. Electrically powered tools. Industrial drying equipment. Ore separating magnets. Magnetic work holders. Lifting magnets. Sewing machines. Industrial components e.g. pumps, fans. (H05B, F27)

## **X26 Lighting**

Discharge, incandescent and electric arc lamps. Operating and control equipment. Light fittings. Portable lighting devices. Stage lighting equipment. (F21, H01J, H01K)

## **X27 Domestic Electric Appliances**

Washing machines, dryers, irons. Vacuum cleaners. Electric cookers, microwave ovens. Kitchen equipment. Refrigerators. Water heaters. Space heating and air conditioning equipment. Personal and hygiene electrical appliances. (A47, F24)



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