

This is the general heading for physical methods of separating gases and for drying gases by the removal of water vapour and, in particular, the general heading for the organisation of single and plural such methods and means therefor. In addition, the heading includes certain unit functions and means therefor occurring in the separation and drying of gases, certain associations of separating and drying operations with functionally different operations, and servicing arrangements for separating and drying operations

The heading is divided into two parts. Part A relates to methods and means for separating and drying by absorption, diffusion through gases, and diffusion through porous or perforated barriers or semi-permeable membranes. Part B relates to methods and means for separating by an operation other than those covered in Part A

Explanation of heading subject matter and relationships with other headings

PART A

Organisation of separating and drying processes and means therefor:

Classified here are disclosures concerned with constructional and functional organisation and modes of operation of single and plural means and methods of separating and/or drying gases by contact with a physically active medium, *eg* an absorbent or a semi-permeable membrane, the relationships between unit functions, and with process characteristics. The material of the contacting agent is also dealt with at this level as a parameter or process condition variable. The disclosure of a novel method is classified under functional organisation. Any disclosure of a novel means for carrying out the method is classified under constructional organisation

Stacks of unlike elements or members are also classified here

Classified under plural methods and means are disclosures concerned with combinations or associations of more than one separating or drying operation, which operations may be similar, or diverse, *eg* absorption and diffusion; absorption and condensation. Disclosures of plural methods and means where the difference between the individual operations lies solely in the material of the contacting agent, *eg* whether gaseous, liquid or solid, are classified as plural similar methods and means. Plural similar methods and means are subdivided into series (a plurality of means arranged consecutively) and parallel (a plurality of means arranged in parallel). Parallel means may include a switching arrangement so that different operations may be effected simultaneously

Excluded are:

- . separating vapours by condensation only—B1B, Distillation; evaporation; condensation
- . gas chromatography—B1H, Chromatography
- . washing air, gases, smoke and fumes—B1R, Treating gases with liquids &c
- . separating fog from air and gases (*otherwise than* by treating with liquids or steam)—B1T, Separating particles from gases
- . the manufacture and treatment of chemical compounds serving as desiccants—*eg* C1A, Inorganic substances
- . separating a component of a predominantly inorganic gas mixture by a chemical reaction—C1A, Inorganic substances
- . chemical separation of predominantly organic gas mixtures *other than* purifying hydrocarbons—C2C, Organic compounds
- . drying acetylene in manufacture—C5E, Destructive pyrolysis, gas, hydrocarbons &c
- . separating hydrocarbons from hydrocarbon gas mixtures—C5E, Destructive pyrolysis, gas, hydrocarbons &c
- . separating gaseous mixtures by processes which involve electrolysis—C7B, Electrolysis
- . drying materials other than air and gases, by admixture with or direct application of desiccants and absorbents—F4G, Drying &c
- . cooling processes and apparatus for drying air and gases—F4K, Direct contact heating of fluids; F4S, Indirect heating and cooling
- . separating gaseous mixtures by liquefying, solidifying, and re-vapourizing—F4P, Gas Storing, liquefying &c

Unit functions:

Classified here are disclosures concerned with unit functions, sub-systems, and elements involved in separating gases by contacting a physically active medium. This subject matter is mainly concerned with means and constructional elements but included are disclosures of new methods of effecting a particular function, *eg* contacting, regeneration. Only the first disclosure of a new contacting method is classified as the method *per se* and subsequent disclosures are classified in accordance with what is novel, *eg* under contacting means. Novel methods and means *per se* for effecting unit functions, *eg* heating, are classified elsewhere where suitable headings exist

Examples are the following:

- Control valves—F2V, Fluid-pressure control valves &c
- Heating/cooling means and methods—F4K, Direct contact heating of fluids; F4S, Indirect heating and cooling; H5H, Electric heating; microwave heating &c

Explanation of Part A of heading—*cont*

It should be noted that stacks of like elements or members are classified at this level

Associations:

Classified here are combinations and associations of separating and drying methods and means with functionally different methods and means, ie with non-separating/drying operations which do not perform a *perfecting function* (see Notes on the Use of the Classification Key). Perfecting functions are classified according to which function or operation is perfected. This heading is only the residual heading for such associations and the remainder may be found in the headings for the non-separating/drying operations, eg, some associations of separation and chemical reactions can be found in C1A, Inorganic substances &c

Excluded are:

- . conditioning and treating air by a combination of two or more treatments which involve a non-separating/drying operation—F4V, Ventilation and air conditioning

Servicing arrangements:

Classified here are indicators, alarms, and those servicing arrangements, eg cleaning, not included under unit functions

PART B

Classified here are disclosures concerned with types of separation not covered in Part A, ie, thermal diffusion, diffusion under the influence of gravity, diffusion under the influence of electric and magnetic fields, and separation jets

Excluded are:

- . centrifugal separators—B2P, Centrifuges
- . separating hydrogen from its isotopes; separating water vapour from heavy water vapour—C1A, Inorganic substances
- . selective excitation of gas mixtures using electromagnetic radiation—G6P, Nucleonics
- . mass spectrometers and analogous separating apparatus—H1D, Electric discharge tubes &c

The exclusion references listed in this heading are not exhaustive. Reference should be made to the appropriate general heading/s for processes, materials, elements or devices which may be more widely applicable than can appropriately be classified in this heading

Relationship with the Universal Indexing Schedules (heading U1S)

In addition to recording the nature of broader processes or apparatus with or in which inventions classified here may be used, U1S is used, subject to its indexing rules, to index materials operated on and useful products obtained, except that where it is clearly intended to produce only a single useful product from a mixture of starting materials the latter are not indexed. U1S is also used to record the nature of operations or apparatus with which subject-matter classified here is associated

Operative date for Key entries

The operative dates of the terms in this heading are:

1. for terms annotated by a marginal code, that of the Edition corresponding to that code
2. for all other terms, earlier than that of Edition A

Classifying, indexing and searching note

Indexing schedule 1 is applied to all disclosures. Indexing schedules 2, 3 and 4 are applied only when certain classifying terms have been assigned. Indexing schedule 5 is applied only when classifying terms from Part B have been assigned. Indexing schedule 6 is applied only when classifying terms from Part A have been assigned. Since the classification of certain disclosures having affinity with two or possibly more subjects cannot be infallible, consideration should be given in such cases to searching both, or all such subjects. For example, the material and structural aspects of the contacting agent are not always distinct, nor heating/cooling/heat balance arrangements (classified at organisational level) and heating/cooling means (classified at unit function level). In this connection see also Notes on the Use of the Classification Key, paragraph 5.1. It should also be borne in mind that when methods and means for performing unit functions, eg heating/cooling, in gas separation apparatus are novel *per se* they are subject matter for other headings

Classifying Schedule

See also Indexing Schedule 1

PART A

See also Indexing Schedule 6

- organisation (constructional and functional) and modes of operation of single contacting apparatus; relationships between unit functions; process characteristics—
- LAA . . . concerned with constructional organisation (*including* stacks of elements or members which differ in some significant respect)
- LAB . . . concerned with functional organisation; *modus operandi*—
- LAC . . . concerned with organisation of feeds, effluent, reflux and contacting agent flows, and organisation of operational zones, (*eg* contacting, desorbing, fractionation zones)
- LAC . . . concerned with heating/cooling/heat balance arrangements
- . . . heating/cooling means *per se*. See term LDH below
- . . . concerned with selection of particular process conditions, parameters (*including* contacting agent) or with procedures—
- LAD . . . with one condition or parameter only or primarily (*except* material of contacting agent). See also Indexing Schedules 2 and 4
- LAE . . . with material of contacting agent. See also Indexing Schedule 3
- in association with particular conditions or procedures. See terms LAH, LAJ below
- LAF for operating on particular feed materials. See also Indexing Schedules 2 and 3
- LAG . . . with material of apparatus
- . . . with plural conditions, parameters or procedures (*including* material of contacting agent). See also Indexing Schedules 2, 3 and 4—
- LAH for operating on particular feed materials (*expressed as product and/or impurity*)
- LAJ other
- LAK . . . concerned with control of operation
- organisation of plural similar apparatus; *modus operandi*—
- . series apparatus—
- LBA . . . concerned with feed & c flow and zone arrangements
- LBB . . . concerned with heating/cooling/heat balance arrangements
- LBC . . . concerned with other *modus operandi including* condition/parameter selection. See also Indexing Schedules 2, 3 and 4
- LBD . . . other
- . parallel—
- LBE . . . concerned with switching means and arrangements *other than* *modus operandi* and selection of conditions
- LBF . . . concerned with feed & c flow and zone arrangements *other than* for switching purposes
- LBG . . . concerned with heating/cooling/heat balance arrangements
- LBH . . . concerned with other *modus operandi including* condition/parameter selection. See also Indexing Schedules 2, 3 and 4
- LBJ . . . other
- LC organisation of plural diverse apparatus. See also Indexing Schedules 2, 3 and 4
- LDA unit functions, sub-systems and elements for contacting gas to be treated with a contacting agent—
- . methods
- . means—
- LDB . . . structural aspect, ie construction of contacting elements (*including* stacks of like elements or members)
- . . . heating/cooling means. See term LDH below
- . . . material of contacting agent. See terms LAE, LAH, LAJ above
- . . . other
- LDC supporting, mounting, housing contacting agent
- LDD . materials aspect. See term LAG above
- introducing, supplying (*eg measured quantities*) to or removing substances from the contacting apparatus—
- . flow control means. See term LDG below
- LDE . metering
- LDF . other
- LDG control means for flow of contacting agent within, without, or into or out of the contacting apparatus
- LDH heating/cooling means
- LDJ regenerating contacting agent
- LDK desorption, stripping of contacting agent
- LDL transportation means
- association with functionally different apparatus—
- LEA . with apparatus in which chemical reactions occur
- LEB . with cooling and refrigerating apparatus
- LEC . other
- LF servicing arrangements *not included* under unit functions; indicators, alarms

Classifying Schedule—contPART B

- separating by methods and means not classified in Part A. *See also* Indexing Schedules 2 and 5—
- LGA . by diffusion across a temperature gradient
 - LGB . by diffusion under the influence of gravity
 - LGC . by diffusion under the influence of electric and/or magnetic fields
 - LGD . by separation jets
 - LGE . other

Indexing Schedule 1

Terms from this Schedule are assigned throughout the Classifying Schedules of Parts A and B

- type of contacting operation—
- L101 . sorption of water vapour
 - L102 . sorption of other vapours and gases
 - L103 . diffusion

Indexing Schedule 2

Terms from this Schedule are only assigned when at least one of the terms LAD, LAF, LAH, LAJ, LBC, LBH, LC has been assigned from the Classifying Schedule of Part A, or at least one term has been assigned from the Classifying Schedule of Part B

- gases to be separated—
- L201 . air
 - L202 . ammonia
 - L203 . carbon dioxide
 - L204 . carbon monoxide
 - L205 . halocarbons
 - L206 . halogens
 - . hydrocarbons, aliphatic—
 - L207 . . acetylene
 - L208 . . olefines
 - L209 . . other
 - . hydrocarbons, aromatic
 - L211 . hydrogen
 - L212 . hydrogen cyanide
 - L213 . hydrogen halides
 - L214 . isotopes
 - L215 . nitrogen
 - L216 . nitrogen, oxides of
 - L217 . oxygen
 - L218 . rare gases
 - . sulphur compounds—
 - L219 . . hydrogen sulphide
 - L220 . . sulphur dioxide
 - L221 . . inorganic sulphur compounds, other
 - L222 . . organic sulphur compounds
 - L223 . water vapour
 - L224 . other inorganic gases
 - L225 . other organic gases

Indexing Schedule 3

Terms from this Schedule are only assigned when at least one of the terms LAE, LAF, LAH, LAJ, LBC, LBH, LC has been assigned from the Classifying Schedule of Part A

- solid absorbents—
- L301 . calcium oxide, calcium chloride, calcium sulphate
 - L302 . carbon
 - L303 . clay
 - L304 . metals
 - L305 . mixtures
 - L306 . oxides, *other than* calcium oxide, silica
 - L307 . silica
 - L308 . zeolites
 - L309 . other

Indexing Schedule 3—cont

- liquid absorbents—
- L311 . hydrochloric acid
 - . organic liquids—
 - L312 . . glycols, polyglycols, ethers and esters thereof
 - L313 . . hydrocarbons
 - L314 . . other
 - L315 . salts
 - L316 . sulphuric acid
 - L317 . water
 - L318 . other
 - L319 membranes

Indexing Schedule 4

Terms from this schedule are only assigned when at least one of the terms LAD, LAH, LAJ, LBC, LBH, LC has been assigned from the Classifying Schedule of Part A

- process parameters and conditions—
- L401 . temperature
 - L402 . pressure
 - L403 . flow velocity
 - L404 . specified quantities, fractions, rates
 - L405 . other

Indexing Schedule 5

Terms from this schedule are only assigned when at least one term has been assigned from the Classifying Schedule of Part B

- division of gas stream—
- . effect—
 - L501 . . dividing a stream into a first and subsequent portion
 - L502 . . dividing a stream into a central and a peripheral portion
 - L503 . . other
 - . means—
 - L504 . . using movable nozzles or slits
 - L505 . . using skimmers, apertured diaphragms, deflecting plates
 - L506 . . using probes
 - L507 . . using an auxiliary gas beam; electromagnetic radiation; electric arc
 - L508 . . using electric and/or magnetic fields
 - L509 . . expanding into a low pressure zone; using pressure pulses
 - L510 . . other

Indexing Schedule 6

Terms from this schedule are only assigned when at least one term has been assigned from the Classifying Schedule of Part A

- separation of gas mixtures—
- m L601 . involving diffusion through membranes or porous bodies
 - . using stationary beds of solid adsorbents—
 - . . with manner of desorption/adsorbent regeneration specified—
 - . . . the desorption/regeneration not involving the essential use of heat—
 - m L602A pressure swing systems/processes
 - m L602X other
 - m L603 . . . the desorption/regeneration requiring the use of heat
 - m L604 . . no specified manner of desorption/regeneration, or regeneration by replacement of adsorbents when saturated
 - . using moving or dispersed solid adsorbents—
 - m L605 . gravity moving beds
 - m L606 . . dispersed solids, eg fluidised beds
 - m L607 . . other (including rotary beds)
 - m L608 . using liquid adsorbents
 - m L609 . using combinations of diffusion, stationary solid adsorbents, moving solid adsorbents and/or liquid adsorbents