

**CLASS 422, CHEMICAL APPARATUS AND PROCESS DISINFECTING, DEODORIZING, PRESERVING, OR STERILIZING**

**SECTION I - CLASS DEFINITION**

This is a generic class for (1) processes of disinfecting, deodorizing, preserving or sterilizing and (2) apparatus for (a) carrying out chemical reactions, (b) preparing or treating chemical compounds or compositions even though only a physical reaction is discernible, (c) performing an analysis which involves either a chemical reaction or a physical reaction not elsewhere provided, for and (d) carrying out the above processes not elsewhere provided for.

**SECTION II - LINES WITH OTHER CLASSES AND WITHIN THIS CLASS**

(A) Processes involving disinfecting, deodorizing, preserving or sterilizing (and apparatus when appropriate) for treating a compound, composition, or by-product by particularly

(1) Preserving by purification only is classified with the appropriate compound, composition, or physical separation class. Where the purification involves a chemical reaction, see the appropriate compound or composition class, Class 423, Chemistry of Inorganic Compounds, subclasses 210+ having the generic art on gas purification involving a chemical reaction. Where there is purification by physical separation only, see the appropriate physical separation class in References To Other Classes below.

(2) By coating, impregnating, or laminating. See References To Other Classes below for class references to this area.

(3) By cleaning. See References To Other Classes below for class references to this area.

(4) By heating, cooking, cooling, and/or drying only. See References To Other Classes below for class references to this area.

(B) Art processes and apparatus are classified with the appropriate art even though the steps of, or means for, disinfecting, deodorizing, preserving, or sterilizing, are claimed in combination therewith. The disinfecting, deodorizing, preserving, or sterilizing subcombination should be cross-referenced to the appropriate place. See

References To Other Classes below for class references to this area.

(C) Other disinfecting, deodorizing, preserving, or sterilizing, per se. See References To Other Classes below for class references to this area.

(D) Apparatus

(1) Analytical apparatus. See References To Other Classes below for class references to this area.

(2) Material preparation or treating apparatus. See References To Other Classes below for class references to this area.

**SECTION III - REFERENCES TO OTHER CLASSES**

SEE OR SEARCH CLASS:

- 4, Baths, Closets, Sinks, and Spittoons, particularly subclasses 111.1, 111.4, 220+, 222+, 261, and 294. (processes and apparatus for disinfecting, deodorizing, preserving, or sterilizing when steps or means are claimed in combination.)
- 8, Bleaching and Dyeing; Fluid Treatment and Chemical Modification of Textiles and Fibers, (processes and apparatus for disinfecting, deodorizing, preserving, or sterilizing when steps or means are claimed in combination.)
- 8, Bleaching and Dyeing; Fluid Treatment and Chemical Modification of Textiles and Fibers, subclasses 94.1+ for the preservation of hides, skins, feathers, and other animal tissues. (disinfecting, deodorizing, preserving, or sterilizing, per se.)
- 15, Brushing, Scrubbing, and General Cleaning, for apparatus for brushing, beating, shaking, wiping, shotting, the use of a squeegee, or the removal of material by a draft or current of air, steam, or equivalent gaseous fluid. (treating a compound, composition, or by-product by cleaning.)
- 15, Brushing, Scrubbing, and General Cleaning, (processes and apparatus for disinfecting, deodorizing, preserving, or sterilizing when steps or means are claimed in combination.)
- 27, Undertaking, particularly subclasses 11 and 21.1+. (processes and apparatus for disinfecting, deodorizing, preserving, or sterilizing when steps or means are claimed in combination.)

- 27, Undertaking, subclasses 21.1+ for embalming. (see above section on disinfecting, deodorizing, preserving, or sterilizing, per se.)
- 28, Textiles: Manufacturing, (processes and apparatus for disinfecting, deodorizing, preserving, or sterilizing when steps or means are claimed in combination.)
- 29, Metal Working, appropriate subclasses for apparatus for making named type articles. (material preparation or treating apparatus.)
- 30, Cutlery, particularly subclasses 124+ and 140. (processes and apparatus for disinfecting, deodorizing, preserving, or sterilizing when steps or means are claimed in combination.)
- 34, Drying and Gas or Vapor Contact With Solids, (physical separation class)
- 34, Drying and Gas or Vapor Contact With Solids, appropriate subclasses for treating solid material by drying or with vapor contact. (material preparation or treating apparatus.)
- 34, Drying and Gas or Vapor Contact With Solids, (treating a compound, composition, or by-product by heating, cooking, cooling, and/or drying only.)
- 43, Fishing, Trapping, and Vermin Destroying, subclasses 124+ for process and apparatus for destroying macroscopic vermin visible to the naked eye. This class (422) provides for process and apparatus generic to destruction of vermin and micro-organisms. (see above section on disinfecting, deodorizing, preserving, or sterilizing, per se.)
- 47, Plant Husbandry, when limited to treating living plants, particularly subclass 57.5 for injecting processes and apparatus. (see above section on disinfecting, deodorizing, preserving, or sterilizing, per se.)
- 44, Fuel and Related Compositions, appropriate subclasses for apparatus for preparing the subject matter of the class. (material preparation or treating apparatus.)
- 48, Gas: Heating and Illuminating, for apparatus for making heating and illuminating gas. (material preparation or treating apparatus.)
- 48, Gas: Heating and Illuminating, (processes and apparatus for disinfecting, deodorizing, preserving, or sterilizing when steps or means are claimed in combination.)
- 52, Static Structures (e.g., Buildings), particularly subclasses 101, 130, 168, and 517 for in situ used building components with attached or built-in preserving features. (art processes and apparatus for disinfecting, deodorizing, preserving, or sterilizing when steps or means are claimed in combination.)
- 53, Package Making, subclasses 428+ for methods; and subclasses 111+ for apparatus for packaging combined with contents treating. (art processes and apparatus for disinfecting, deodorizing, preserving, or sterilizing when steps or means are claimed in combination.)
- 53, Package Making, subclasses 111+ for packaging apparatus with contents material treating. (material preparation or treating apparatus.)
- 55, Gas Separation, (physical separation class)
- 60, Power Plants, appropriate subclasses for power plants using named chemical material. (material preparation or treating apparatus.)
- 62, Refrigeration, particularly subclass 78 and subclass 331 for processes and apparatus for preserving by refrigeration, including such steps or means combined with deodorizing, antisepticizing or germiciding the material which is subjected to refrigeration or providing a special atmosphere in a cooled space. (see above section on disinfecting, deodorizing, preserving, or sterilizing, per se.)
- 62, Refrigeration, appropriate subclasses for apparatus for cooling or freezing, especially subclass 330 for such apparatus with means for making the refrigerant. (material preparation or treating apparatus.)
- 62, Refrigeration, particularly subclass 78, and subclass 331 for processes and apparatus for preserving by refrigeration, including such steps or means combined with deodorizing, antisepticizing or germiciding the material which is subjected to refrigeration or providing a special atmosphere in a cooled space. (art processes and apparatus for disinfecting, deodorizing, preserving, or sterilizing when steps or means are claimed in combination.)
- 65, Glass Manufacturing, appropriate subclasses for apparatus for making glass including glass in the form of filaments or fibers. (material preparation or treating apparatus.)
- 68, Textiles: Fluid Treating Apparatus, subclass 1 and 2 for waste reclaiming and carbonizing apparatus, respectively. (material preparation or treating apparatus.)
- 73, Measuring, and Testing, for apparatus for making tests and measurements not otherwise provided for. See particularly subclass 36 for testing illuminating fluids for flash point, vapor pressure, and end point. (analytical apparatus.)
- 95, Gas Separation: Processes, (physical separation class)

- 96, Gas Separation: Apparatus, for apparatus for gas separation not involving a chemical reaction. (material preparation or treating apparatus.)
- 96, Gas Separation: Apparatus, (physical separation class)
- 99, Foods and Beverages: Apparatus, (treating a compound, composition, or by-product by heating, cooking, cooling, and/or drying only.)
- 99, Food and Beverages: Apparatus, subclasses 467+ for subjecting food to a modified atmosphere; and subclasses 518+ and 600+ for grain hulling which may involve the removal of smut and other organisms by substantial rubbing, abrading, etc. (see above section on disinfecting, deodorizing, preserving, or sterilizing, per se.)
- 99, Foods and Beverages: Apparatus, appropriate subclass for food making and treating apparatus. (material preparation or treating apparatus.)
- 100, Presses, subclasses 70+ for apparatus for pressing combined with means providing an additional treatment of the material being pressed. (material preparation or treating apparatus.)
- 101, Printing, (art processes and apparatus for disinfecting, deodorizing, preserving, or sterilizing when steps or means are claimed in combination.)
- 110, Furnaces, (treating a compound, composition, or by-product by heating, cooking, cooling, and/or drying only.)
- 110, Furnaces, subclasses 235+ for apparatus for burning wet fuel, garbage and sewage, and refuse, respectively. (material preparation or treating apparatus.)
- 117, Single-Crystal, Oriented-Crystal, and Epitaxy Growth Processes; Non-Coating Apparatus Therefor, for non-coating apparatus for growing therein-defined single-crystal of all types of materials, including inorganic or organic. (material preparation or treating apparatus.)
- 118, Coating Apparatus, appropriate subclasses for coating apparatus combined with means to treat the work or coating. (This search note is related to material preparation or treating apparatus.)
- 119, Animal Husbandry, (art processes and apparatus for disinfecting, deodorizing, preserving, or sterilizing when steps or means are claimed in combination.)
- 119, Animal Husbandry, subclass 156 for antivermin treatment. (see above section on disinfecting, deodorizing, preserving, or sterilizing, per se.)
- 122, Liquid Heaters and Vaporizers, (treating a compound, composition, or by-product by heating, cooking, cooling, and/or drying only.)
- 122, Liquid Heaters and Vaporizers, subclass 21 for boiler heated by chemical action other than combustion of fuel; and subclasses 379+ for boiler having means to clean same. (material preparation or treating apparatus.)
- 126, Stoves and Furnaces, subclasses 263.01+ for means for creating heat by chemical action. (material preparation or treating apparatus.)
- 127, Sugar, Starch, and Carbohydrates, subclasses 1+ for apparatus for treating sugars, starches, and carbohydrates material. (material preparation or treating apparatus.)
- 126, Stoves and Furnaces, (treating a compound, composition, or by-product by heating, cooking, cooling, and/or drying only.)
- 127, Sugar, Starch, and Carbohydrates, (physical separation class)
- 128, Surgery, (art processes and apparatus for disinfecting, deodorizing, preserving, or sterilizing when steps or means are claimed in combination.)
- 131, Tobacco, subclass 290, particularly subclasses 290 and 300. (see above section on disinfecting, deodorizing, preserving, or sterilizing, per se.)
- 134, Cleaning and Liquid Contact With Solids, subclasses 43+ for cleaning apparatus or liquid contact with solids apparatus. (material preparation or treating apparatus.)
- 134, Cleaning and Liquid Contact With Solids, for cleaning processes (including those performed by the apparatus of Class 15 for cleaning apparatus not otherwise provided for). (treating a compound, composition, or by-product by cleaning.)
- 136, Batteries: Thermoelectric and Photoelectric, appropriate subclasses for means for generating an electrical current. (material preparation or treating apparatus.)
- 137, Fluid Handling, subclasses 15.1+ for apparatus for handling fluids. (material preparation or treating apparatus.)
- 136, Batteries: Thermoelectric and Photoelectric, (art processes and apparatus for disinfecting, deodorizing, preserving, or sterilizing when steps or means are claimed in combination.)
- 137, Fluid Handling, subclasses 88+ for systems for controlling the mixture of a plurality of fluids in response to the sensing of a condition or

	characteristic of the mixture, note particularly subclass 93 in which the control is in response to a sensing of a chemical property. (analytical apparatus.)		a reaction provided for in that class. (analytical apparatus.)
141,	Fluent Material Handling, With Receiver or Receiver Coacting Means, (art processes and apparatus for disinfecting, deodorizing, preserving, or sterilizing when steps or means are claimed in combination.)	201,	Distillation: Processes, Thermolytic, (physical separation class).
148,	Metal Treatment, (art processes and apparatus for disinfecting, deodorizing, preserving, or sterilizing when steps or means are claimed in combination.)	202,	Distillation: Apparatus, (material preparation or treating apparatus.)
156,	Adhesive Bonding and Miscellaneous Chemical Manufacture, subclasses 345.1 through 345.55 for etching adhesive bonding and various types chemical manufacture apparatus. (material preparation or treating apparatus.)	202,	Distillation: Apparatus, (physical separation class).
159,	Concentrating Evaporators, (physical separation class)	203,	Distillation: Processes, Separatory, (physical separation class).
162,	Paper Making and Fiber Liberation, (art processes and apparatus for disinfecting, deodorizing, preserving, or sterilizing when steps or means are claimed in combination.)	204,	Chemistry: Electrical and Wave Energy, (physical separation class).
159,	Concentrating Evaporators, for means concentrating solids held in a solution of suspension. (material preparation or treating apparatus.)	204,	Chemistry: Electrical and Wave Energy, subclasses 193+ for apparatus for that class. (Material preparation or treating apparatus.)
162,	Paper Making and Fiber Liberation, subclasses 232+ for apparatus for making paper or liberating fiber. (material preparation or treating apparatus.)	204,	Chemistry: Electrical and Wave Energy, subclasses 194+ for electrolytic apparatus, in general, including that used for preserving, disinfecting, or sterilizing, and other appropriate subclasses for electrical or wave energy methods for the production of chlorine, ozone, or other preserving, disinfecting, or sterilizing agents. (see above section on disinfecting, deodorizing, preserving, or sterilizing, per se.)
164,	Metal Founding, subclasses 139+ for apparatus for moulding metal. (material preparation or treating apparatus.)	204,	Chemistry: Electrical and Wave Energy, subclasses 400 through 435 for apparatus specialized for the determination of hydrogen ion concentration of solutions. (analytical apparatus.)
165,	Heat Exchange, (treating a compound, composition, or by-product by heating, cooking, cooling, and/or drying only.)	205,	Electrolysis: Processes, Compositions Used Therein, and Methods of Preparing the Compositions, subclasses 334+ for electrolytic synthesis of chlorine, ozone, or other preserving, disinfecting, or sterilizing agents and subclasses 687+ for electrolytic material treatment processes, especially subclass 701 for electrolytic treatment of biological material (e.g., sterilizing, etc.). (See above section on disinfecting, deodorizing, preserving, or sterilizing, per se.)
166,	Wells, (art processes and apparatus for disinfecting, deodorizing, preserving, or sterilizing when steps or means are claimed in combination.)	206,	Special Receptacle or Package, subclass .5 for infusion containing receptacle; and subclasses 524.1+ for container with specified material or content. (material preparation or treating apparatus.)
169,	Fire Extinguishers, (art processes and apparatus for disinfecting, deodorizing, preserving, or sterilizing when steps or means are claimed in combination.)	208,	Mineral Oils: Processes and Products, (physical separation class).
169,	Fire Extinguishers, especially subclass 6 and 7 for fire extinguishers operable as a result of chemical action. (material preparation or treating apparatus.)	209,	Classifying, Separating, and Assorting Solids, (physical separation class).
196,	Mineral Oils: Apparatus, (material preparation or treating apparatus.)	210,	Liquid Purification or Separation, (physical separation class).
196,	Mineral Oils: Apparatus, subclasses 132 and 141 for combinations of apparatus for making a test or measurement and means for controlling	210,	Liquid Purification or Separation, subclasses 600+ for processes; and subclasses 85 and 542 for apparatus for other liquid purification. (see above section on disinfecting, deodorizing, preserving, or sterilizing, per se.)

- 210, Liquid Purification or Separation, subclasses 85+ for apparatus for purifying a liquid. (material preparation or treating apparatus.)
- 215, Bottles and Jars, appropriate subclasses for bottles, jars, closures, and attachments therefor. (material preparation or treating apparatus.)
- 219, Electric Heating, appropriate subclasses for electrical heating devices. (material preparation or treating apparatus.)
- 219, Electric Heating, (treating a compound, composition, or by-product by heating, cooking, cooling, and/or drying only.)
- 222, Dispensing, appropriate subclasses for dispensing apparatus. (material preparation or treating apparatus.)
- 228, Metal Fusion Bonding, subclasses 2+ for fusion bonding apparatus. (material preparation or treating apparatus.)
- 239, Fluid Sprinkling, Spraying, and Diffusing, (material preparation or treating apparatus.)
- 241, Solid Material Comminution or Disintegration, subclasses 31+ for comminution apparatus combined with material treating means. (material preparation or treating apparatus.)
- 241, Solid Material Comminution or Disintegration, (physical separation class).
- 241, Solid Material, Comminution or Disintegration, for comminuting combined with physical preservation, sterilization, or disinfecting where the combined step or means is of the type provided for as a combination in that class (241). (art processes and apparatus for disinfecting, deodorizing, preserving, or sterilizing when steps or means are claimed in combination.)
- 261, Gas and Liquid Contact Apparatus, Class 422 has no preservative by either purification involving a chemical reaction or by physical separation. (physical separation class)
- 261, Gas and Liquid Contact Apparatus, (material preparation or treating apparatus.)
- 264, Plastic and Nonmetallic Article Shaping or Treating: Processes, (art processes and apparatus for disinfecting, deodorizing, preserving, or sterilizing when steps or means are claimed in combination.)
- 266, Metallurgical Apparatus, (treating a compound, composition, or by-product by heating, cooking, cooling, and/or drying only.)
- 266, Metallurgical Apparatus, subclass 80 for automatic means with an analyzer. (analytical apparatus.)
- 299, Mining or In Situ Disintegration of Hard Material, subclass 5 for apparatus for in situ conversion of solid to fluid by dissolving or chemical action. (material preparation or treating apparatus.)
- 312, Supports: Cabinet Structure, subclasses 31+ for cabinet structure support with gas or vapor treatment of material. (material preparation or treating apparatus.)
- 324, Electricity: Measuring and Testing, appropriate subclasses for apparatus for testing an electrical property or condition of a material by electrical means, even though the results of the test may be used as an indication of some other physical or chemical property or condition. (analytical apparatus.)
- 346, Recorders, for recording apparatus, per se. (analytical apparatus.)
- 366, Agitating, subclass 142 for agitating means with a test, signal, or indicator means. (analytical apparatus.)
- 373, Industrial Electric Heating Furnaces, (treating a compound, composition, or by-product by heating, cooking, cooling, and/or drying only.)
- 376, Induced Nuclear Reactions: Processes, Systems, and Elements, subclasses 340+ for generally treating materials within a nuclear reactor including for such purposes as preserving, disinfecting, and sterilizing. (see above section on disinfecting, deodorizing, preserving, or sterilizing, per se.)
- 378, X-Ray or Gamma Ray Systems or Devices, subclasses 64+ for x-irradiation. (see above section on disinfecting, deodorizing, preserving, or sterilizing, per se.)
- 379, Telephonic Communications, subclass 452 for antiseptic protectors for telephones. (This search note is related to other disinfecting, deodorizing, preserving, or sterilizing, per se.)
- 374, Thermal Measuring and Testing, subclass 8 for flammability testing; and subclasses 31+ for calorimetry. (analytical apparatus.)
- 366, Agitating, appropriate subclasses for agitating apparatus. (material preparation or treating apparatus.)
- 373, Industrial Electric Heating Furnaces, subclasses 109+ for carbon treating apparatus. (material preparation or treating apparatus.)
- 376, Induced Nuclear Reactions: Processes, Systems, and Elements, appropriate subclasses for apparatus for carrying out nuclear reactions. (material preparation or treating apparatus.)

- 396, Photography, subclasses 564+ for fluid-treating apparatus for photographic film. (material preparation or treating apparatus.)
- 414, Material or Article Handling, appropriate subclasses for article or material handling, usually of general utility. (material preparation or treating apparatus.)
- 424, Drug, Bio-Affecting and Body Treating Compositions, appropriate subclasses for process involving mere use of the composition of that class (424). (This search note is related to other disinfecting, deodorizing, preserving, or sterilizing, per se.)
- 426, Food or Edible Material: Processes, Compositions, and Products, subclasses 312+ and 321+ for preservation of edible materials. (see above section on disinfecting, deodorizing, preserving, or sterilizing, per se.)
- 435, Chemistry: Molecular Biology and Microbiology, (see above section on disinfecting, deodorizing, preserving, or sterilizing, per se.)
- 425, Plastic Article or Earthenware Shaping or Treating: Apparatus, including apparatus for pelletizing, agglomerating, or granulating. (material preparation or treating apparatus.)
- 429, Chemistry: Electrical Current Producing Apparatus, Product, and Process, appropriate subclasses for means for producing electricity caused by a chemical reaction. (material preparation or treating apparatus.)
- 431, Combustion, for apparatus for burning material. (material preparation or treating apparatus.)
- 432, Heating, for heating apparatus. (material preparation or treating apparatus.)
- 435, Chemistry: Molecular Biology and Microbiology, subclasses 283.1+ for apparatus for propagating, treating, or containing enzymes or living organisms or for fermenting. (material preparation or treating apparatus.)
- 494, Imperforate Bowl: Centrifugal Separators, (material preparation or treating apparatus.)
- 426, Food or Edible Material: Processes, Compositions, and Products (treating a compound, composition, or by-product by heating, cooking, cooling, and/or drying only.)
- 427, Coating Processes, for preserving a substance by coating, including the compounds, classified in Class 423, Chemistry of Inorganic Compounds and Class 260 Chemistry of Carbon Compounds, when the preserving is done by a coating operation which is, per se, classified in Class 427. (treating a compound, composition, or by-product by coating, impregnating, or laminating.)
- 432, Heating, (treating a compound, composition, or by-product by heating, cooking, cooling, and/or drying only.)
- 435, Chemistry: Molecular Biology and Microbiology, (physical separation class)
- 436, Chemistry: Analytical and Immunological Testing, (physical separation class)
- 493, Manufacturing Container or Tube From Paper; or Other Manufacturing From a Sheet or Web, (see above section on disinfecting, deodorizing, preserving, or sterilizing, per se.)
- 494, Imperforate Bowl: Centrifugal Separators, (physical separation class)
- 506, Combinatorial Chemistry Technology: Method, Library, Apparatus, subclasses 33 through 40 for apparatus specially adapted for use in combinatorial chemistry or with a library such as in identifying, screening, or creating a library.
- 533, through 570, Organic Compounds, appropriate subclasses. (physical separation class)
- 585, Chemistry of Hydrocarbon Compounds, particularly subclasses 2+ and 800+. (physical separation class)
- 588, Hazardous or Toxic Waste Destruction or Containment, subclass 299 for the destruction of germ warfare agents by any method, subclasses 300-321 for processes of destruction by any chemical means of hazardous or toxic waste to make such waste safe for landfill disposal, and subclasses 249-260 for processes of permanently storing hazardous or toxic waste per se, particularly subclass 258 for storage of pathogenic organisms (e.g., virus, bacteria, or medical waste).
- D10, Measuring, Testing, or Signaling Instruments, for design patents pertaining to the subject matter of the class. (analytical apparatus.)

## SUBCLASSES

- 1 PROCESS DISINFECTING, PRESERVING, DEODORIZING, OR STERILIZING:**  
This subclass is indented under the class definition. Process for maintaining a protective environment or counteracting destructive environment by disinfection, deodorizing, preserving, or sterilizing.

- (1) Note. Manufacturing articles or stock material to be resistant to deterioration in use, as by adding a stabilizer or by processes of manufacture, are classifiable, per se, in; e.g., Classes 156, 264, 427, etc.
- (2) Note. Manufacturing or processing steps classifiable, per se, in a class when combined with a step(s) proper for this class is classified in the, per se, class and crossed to this Class 422.

**SEE OR SEARCH THIS CLASS, SUBCLASS:**

127, for apparatus for destroying organisms by the sudden release of high pressure.

**SEE OR SEARCH CLASS:**

62, Refrigeration, particularly subclasses 78, and 331 for processes and apparatus for preserving by refrigeration, including such steps or means combined with deodorizing, antisepticizing or germiciding the material which is subjected to refrigeration or providing a special atmosphere in a cooled space.

210, Liquid Purification or Separation, subclasses 748.01 through 748.2 for liquid purification or separation processes utilizing electrical or wave energy directly applied to liquid or material being treated. See particularly subclass 748.03 for liquid purification or separation processes utilizing sound waves in a process involving the killing of living organisms, subclass 748.07 for liquid purification or separation processes utilizing microwaves, and subclasses 748.11 and 748.12 for liquid purification or separation processes utilizing ultraviolet light in a process involving the killing of living organisms.

379, Telephonic Communications, subclass 452 for antiseptic telephone protectors.

424, Drug, Bio-Affecting and Body Treatment Compositions, subclasses 76.1+ for deodorant compositions which are not applied to the living body which

function by destroying the odor-causing organism or by desensitizing the olfactory mechanism.

588, Hazardous or Toxic Waste Destruction or Containment, subclasses 300 through 321 for processes of destruction by any chemical means of hazardous or toxic waste to make such waste safe for landfill disposal, and subclasses 249-260 for processes of permanently storing hazardous or toxic waste per se, particularly subclass 249.5 for permanent storage of chemical or germ warfare agents, or pathogenic organisms (e.g., sarin, VX, anthrax, virus, bacteria, medical waste, etc.).

**2 Step of warning or decreasing hazard of process:**

This subclass is indented under subclass 1. Process including a step intended to increase the safety of or decrease the danger of the process or to warn persons away from an area where a dangerous process is being performed.

(1) Note. The danger must be caused by the process itself. Preserving against a hazard is placed below.

**3 Process control in response to analysis:**

This subclass is indented under subclass 1. Process wherein the disinfecting, deodorizing, preserving, or sterilizing step is carried out in response to a step of chemical analysis.

(1) Note. The analysis must be of the article or material which is acted upon, of the environment, or of an added agent.

**SEE OR SEARCH CLASS:**

436, Chemistry: Analytical and Immunological Testing, subclasses 1+ for analytical and analytical-control methods.

**4 A gas is substance acted upon:**

This subclass is indented under subclass 1. Process where the substance being acted upon is a gas.

(1) Note. There must be an intent to treat a gas. Using a gas as a carrier for a disin-

fectant or other material, etc., is placed below.

attack of structures by marine organisms.

SEE OR SEARCH THIS CLASS, SUBCLASS:

9, for treatment of gas to render it non-destructive to metal.

### 5 **Deodorizing:**

This subclass is indented under subclass 1. Process wherein an offensive odor is destroyed or masked.

SEE OR SEARCH CLASS:

62, Refrigeration, particularly subclasses 78, and 331 for processes and apparatus for preserving by refrigeration, including such steps or means combined with deodorizing, antisepticizing or germiciding the material which is subjected to refrigeration or providing a special atmosphere in a cooled space.

424, Drug, Bio-Affecting and Body Treating Compositions, subclasses 65+ for cosmetic containing a deodorant, and subclasses 76.1+ for nonbody treating deodorant compositions. Class 424 provides for process of deodorizing involving only the mere application of a Class 424 composition.

512, Perfume Compositions, subclasses 1 through 27.

### 6 **Affecting structure, article, etc., submerged in marine environment:**

This subclass is indented under subclass 1. Process for preserving structures, e.g., ships, docks, etc., used in open bodies of water, e.g., lakes, ponds, rivers, etc.

SEE OR SEARCH CLASS:

106, Compositions: Coating or Plastic, subclass 14 for antifouling paints of the type proper for that class and nominal methods of application.

424, Drug, Bio-Affecting and Body Treating Compositions, subclass 78.09 for anti-fouling paints based on synthetic resins and nominal methods of application.

427, Coating Processes, for significant processes of coating or impregnating with a substance which prevents the

### 7 **Maintaining environment nondestructive to metal:**

This subclass is indented under subclass 1. Process for modifying an environment in contact with metal in a manner that damage or destruction of the metal, by other than mechanical means, is decreased or eliminated.

(1) Note. Articles or compositions and their mere method of manufacture are classified in the relevant classes even though they contain additives or features intended to prevent damage; e.g., corrosion, etc., to the metal which they come into contact with or which is part of the article. However, processes which require a continued ongoing maintenance of a condition are considered more than mere methods of manufacture and are classified hereunder.

(2) Note. Art processes combined with steps of preventing damage to metal; e.g., anti-corrosion, etc., are classified with the relevant process. However, this and indented subclasses provide for nominal art processes wherein the only positive steps recited are those of preventing damage to the metal; e.g., corrosion, etc.

### 8 **Using protective article (e.g., antitarnish fabric, etc.):**

This subclass is indented under subclass 7. Process involving use of an article or stock material to protect metal other than by mere mechanical barrier.

SEE OR SEARCH CLASS:

206, Special Receptacle or Package, subclasses 205+ and 524.4 for subject matter of that class having antitarnish feature.

312, Supports: Cabinet Structure, subclasses 31+ for structures of that class combined with gas or vapor treatment of material.

428, Stock Material or Miscellaneous Articles, for stock material or miscellaneous articles which do not contain metal protective feature; e.g., anticorrosion, etc.



- 9 Using gaseous preservative, preservative added to gaseous phase of environment, or maintaining gaseous phase nondestructive:**  
This subclass is indented under subclass 7. Process wherein (a) the agent used to prevent damage to metal is a gas, (b) a substance is added to the gaseous phase to prevent damage to the metal contacted by the gaseous phase, or (c) the gaseous phase is treated to prevent it from damaging the metal.
- SEE OR SEARCH CLASS:  
312, Supports: Cabinet Structure, subclasses 31+ for structures of that class combined with gas or vapor treatment of material.
- 10 Manipulating gaseous environment for preservative purpose:**  
This subclass is indented under subclass 9. Process involving the step of handling the gaseous phase which is for the sole purpose of preventing damage to metal other than, per se, adding a substance to the gaseous phase.
- SEE OR SEARCH CLASS:  
95, Gas Separation: Processes, appropriate subclasses for gas purification, per se, not combined with the use of treated gaseous phase to preserve metal.
- 11 Steam environment:**  
This subclass is indented under subclass 9. Process wherein the gaseous phase is essentially water at a temperature above its boiling point at the prevailing pressure.
- 12 Aqueous acid environment (i.e., pH less than or equal to 4.1):**  
This subclass is indented under subclass 7. Process for preventing damage to metal caused by an environment which contains water and a protonic acid as strong as H<sub>2</sub>SO<sub>4</sub> or stronger (i.e., pH less than or equal to 4.1).<sub>2</sub>
- (1) Note. See subclass 13 definition for the definition of an aqueous alkaline solution as used therein.
- 13 Aqueous alkali environment (i.e., pH greater than or equal to 8.4):**  
This subclass is indented under subclass 7. Process for preventing damage to metal caused by an environment which contains water and an alkali as strong as NaOH in aqueous solution or stronger (i.e., pH greater than or equal to 8.4).<sub>3</sub>
- (1) Note. See subclass 12 definition for the definition of an aqueous acid solution as used therein.
- 14 Essentially pure water environment:**  
This subclass is indented under subclass 7. Process for preventing damage to metal by an environment which is essentially liquid water.
- (1) Note. "Essentially pure water" is defined as water of at least industrial purity, containing no significant intentional additive intended to perfect it for an art use not possessed by water, per se. It is recognized that industrial water contains many incidental impurities and even though the nature and amount are specifically stated, the presence of these substances will not prevent classification here hereunder, nor will impurities which build up in a water system during use; e.g., boiler, etc. The following are considered essentially pure water: carbonic acid solutions which are the mere result of operating in ambient air; boiler water and cooling water even if they contain small amounts of other intentional perfecting additives; e.g., biocides, etc. Sea water is not considered essentially pure.
- 15 Using organic compound having phosphorus:**  
This subclass is indented under subclass 14. Process wherein an organic compound containing phosphorus is employed to reduce damage to metal by essentially pure water.
- (1) Note. The term "organic" is used as defined in Class 260.
- (2) Note. Included in this subclass are inorganic phosphorus acid salts of organic compounds; e.g., amine phosphates, etc.

- 16 Using organic nitrogen compound other than ammonium salt:**  
Process under subclass wherein an organic nitrogen compound is employed.

(1) Note. The presence of the NH<sup>+</sup> ion in an organic salt will not be considered to make the compound nitrogen containing for purposes of this subclass.<sup>4</sup>

- 17 Using organic carboxylic acid or salt thereof:**

This subclass is indented under subclass 14. Process wherein an organic carboxylic acid or salt thereof is employed.

- 18 Using inorganic silicon or phosphorus compound:**

This subclass is indented under subclass 14. Process wherein an inorganic silicon or phosphorus compound is employed.

- 19 Using heavy metal or compound thereof:**

This subclass is indented under subclass 14. Process wherein a metal of specific gravity of 4 or greater or a compound thereof is employed.

- 20 Using sonic or ultrasonic energy:**

This subclass is indented under subclass 1. Process including the step of treating the article or material with vibratory energy of the frequency of 10 cps or greater.

SEE OR SEARCH THIS CLASS, SUBCLASS:

127, for apparatus for destroying organisms by the sudden release of high pressure.

SEE OR SEARCH CLASS:

134, Cleaning and Liquid Contact With Solids, subclass 1 for combination of cleaning and stabilizing, wherein ultrasonic energy is employed.

- 21 Using microwave energy:**

This subclass is indented under subclass 1. Process including the step of treating the article or material with electromagnetic waves in the range of  $3 \times 10\text{Hz}$  to  $3 \times 10^{10}\text{Hz}$ ; i.e., the so-called "microwave" range.<sup>911</sup>

SEE OR SEARCH CLASS:

219, Electric Heating, subclasses 600+ for inductive heating, subclasses 678+ for microwave heating, and subclasses 764+ for capacitive dielectric heating.

- 22 Using direct contact with electrical or electromagnetic radiation:**

This subclass is indented under subclass 1. Process including the step of treating the article or material with electrical energy or electromagnetic radiation.

(1) Note. Ordinary radiant heating, e.g., as in an oven, is included herein.

SEE OR SEARCH CLASS:

95, Gas Separation: Processes, subclasses 57+ for methods of gas separation involving electrostatic precipitation by ionization of air in which ozone may additionally be generated.

205, Electrolysis: Processes, Compositions Used Therein, and Methods of Preparing the Compositions, subclasses 687+ for electrolytic material treatment processes, especially subclass 701 for electrolytic treatment of biological material (e.g., sterilizing, etc.).

250, Radiant Energy, subclasses 324+ for methods of corona irradiation; subclasses 432+ for the irradiation of contained, supported, or transferred fluent material; subclasses 453.11+ for methods of irradiating supported objects; subclasses 459.1+ for methods of irradiating fluorescent and phosphorescent materials, and subclasses 492.1+ for methods of irradiating objects or materials generally.

426, Food or Edible Material: Processes, Compositions, and Products, subclasses 237+ for process of treating edible material with electrical or wave energy.

- 23 In atmosphere other than air:**

This subclass is indented under subclass 22. Process wherein the treatment takes place in a specified atmosphere other than air.

- 24 Ultraviolet:**  
This subclass is indented under subclass 22. Process wherein the electromagnetic radiation has a frequency in the range of  $7 \times 10\text{Hz}$  to  $3 \times 10^{16}\text{Hz}$ ; i.e., the so-called ultraviolet range".<sup>1416</sup>
- (1) Note. X-rays having a frequency greater than  $3 \times 10^{16}\text{Hz}$  are not included herein.<sup>16</sup>
- 25 Including additional step of preventing damage to sealed container:**  
This subclass is indented under subclass 1. Process wherein the article is a sealed container and wherein the process includes a step or condition intended to prevent physical damage to the container.
- 26 Using direct contact steam to disinfect or sterilize:**  
This subclass is indented under subclass 1. Process wherein water vapor at a temperature above the boiling point of liquid water at the pressure employed is used to directly contact and destroy noxious organisms.
- 27 And additional disinfecting or sterilizing agent:**  
This subclass is indented under subclass 26. Process wherein an additional agent is used to disinfect or sterilize in admixture with steam.
- 28 Using disinfecting or sterilizing substance:**  
This subclass is indented under subclass 1. Process wherein an article or material is treated with a substance to disinfect or sterilize by more than the mere effect of heat.
- (1) Note. A treating substance used in a disinfecting or sterilizing process is considered to be a disinfecting or sterilizing agent unless its effect is disclosed to be merely that of heating.
- SEE OR SEARCH CLASS:  
62, Refrigeration, particularly subclasses 78, and subclass 331 for processes and apparatus for preserving by refrigeration, including such steps or means combined with deodorizing, antisepticizing or germiciding the material which is subjected to refrigeration or providing a special atmosphere in a cooled space.
- 29 In situ generation of agent other than aldehyde or glycol:**  
This subclass is indented under subclass 28. Process wherein the agent is prepared at the site of the process for immediate use and is other than an aldehyde or glycol.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
36, for process of generating an aldehyde in situ.
- 30 And removing the agent by chemical reaction or sorption:**  
This subclass is indented under subclass 28. Process wherein the disinfecting or sterilizing substance is removed or destroyed after treatment by use of a chemical reaction, absorption, or adsorption.
- 31 And recovering or reusing the agent:**  
This subclass is indented under subclass 28. Process wherein the substance is recovered for reuse or is recycled to another step of disinfecting or sterilizing.
- 32 Treating bulk material:**  
This subclass is indented under subclass 28. Process wherein the material being treated is particulate matter handled in bulk of mass, e.g., sand as opposed to articles handled individually.
- 33 With positive pressure or vacuum:**  
This subclass is indented under subclass 28. Process including a step of placing the material or article under pressure either below or above the ambient pressure.
- 34 Using alkylene oxide:**  
This subclass is indented under subclass 28. Process wherein the disinfecting or sterilizing substance is an alkylene oxide; i.e., containing the group  $\text{R}-\text{CH}_2-\text{CH}_2$  wherein R is a hydrocarbon or hydrogen.<sup>2</sup>
- SEE OR SEARCH CLASS:  
514, Drug, Bio-Affecting and Body Treating Compositions, subclasses 449 and 475 for disinfecting compositions containing an alkylene oxide.

**35 Using cyanide:**

This subclass is indented under subclass 28. Process wherein the disinfecting or sterilizing substance is a cyanide, i.e., contains the group - C N.

**SEE OR SEARCH CLASS:**

424, Drug, Bio-Affecting and Body Treating Compositions, especially subclasses 607+ for disinfecting and sterilizing composition containing a cyanide or nitrite (N) compound.

514, Drug, Bio-Affecting and Body Treating Compositions, subclasses 112 and 519+.

**36 Using aldehyde:**

This subclass is indented under subclass 28. Process wherein the disinfecting or sterilizing substance contains an aldehyde group; i.e., - CH.

- (1) Note. This subclass also includes process wherein the disinfecting or sterilizing substance is an aldehyde yielding substance; e.g., paraformaldehyde, etc.

**SEE OR SEARCH CLASS:**

514, Drug, Bio-Affecting and Body Treating Compositions, especially subclasses 693+ for disinfecting or sterilizing compositions containing aldehyde.

**37 Using halogen or halogen-containing compound:**

This subclass is indented under subclass 28. Process wherein the disinfecting or sterilizing substance contains a halogen or a halogen-containing compound.

**SEE OR SEARCH CLASS:**

424, Drug, Bio-Affecting and Body Treating Compositions, appropriate subclasses for disinfecting or sterilizing compositions containing a halogen.

**38 Using fluent heat transfer medium other than air:**

This subclass is indented under subclass 1. Process wherein the article or material is treated by heating the same with a fluent heat transfer medium other than air.

- (1) Note. When it cannot be determined whether a fluent medium is only for heat transfer or whether the medium is also a disinfecting or sterilizing agent, the patent is placed in subclass 28 and cross-referenced here. See note in subclass 28.

**39 By sudden release of pressure:**

This subclass is indented under subclass 1. Process wherein the article or material is subjected to a high pressure which is suddenly released.

- (1) Note. Most patents in this subclass are drawn to the destruction of micro-organisms; e.g., bacteria, etc.

**SEE OR SEARCH THIS CLASS, SUBCLASS:**

127, for apparatus for destroying organisms by the sudden release of high pressure.

**40 Process of storage or protection:**

This subclass is indented under subclass 1. Process directed to residual processes of storage or protection of articles or materials provided for under the definition 1.

- (1) Note. This subclass requires a continuing or ongoing process. A single uniform admixture with preserving agent is not included herein.

**SEE OR SEARCH CLASS:**

62, Refrigeration, particularly subclasses 78, and 331 for processes and apparatus for preserving by refrigeration, including such steps or means combined with deodorizing, antisepticizing or germiciding the material which is subjected to refrigeration or providing a special atmosphere in a cooled space.

426, Food or Edible Material: Processes, Compositions, and Products, subclass 418 for process of storing solid foods under controlled condition.

**41 Of liquid:**

This subclass is indented under subclass 40. Process wherein the substance stored or protected is a liquid under the conditions employed.

- (1) Note. Included herein is the storage in a molten state of a material solid at room temperature.

**SEE OR SEARCH CLASS:**

516, Colloid Systems and Wetting Agents; Subcombinations Thereof; Processes of Making, Stabilizing, Breaking, or Inhibiting, subclasses 9+ for continuous liquid phase colloid systems (e.g., foams, emulsions, suspensions, dispersions) or agents for such systems or making or stabilizing such systems or agents, when generically claimed or when there is no hierarchically superior provision in the USPC for the specifically claimed art.

**42 By preventing evaporation:**

This subclass is indented under subclass 41. Process wherein the liquid is protected against loss by evaporation.

**SEE OR SEARCH CLASS:**

516, Colloid Systems and Wetting Agents; Subcombinations Thereof; Processes of Making, Stabilizing, Breaking, or Inhibiting, subclasses 9+ for continuous liquid phase colloid systems (e.g., foams, emulsions, suspensions, dispersions) or agents for such systems or making or stabilizing such systems or agents, when generically claimed or when there is no hierarchically superior provision in the USPC for the specifically claimed art.

**43 Of water:**

This subclass is indented under subclass 42. Process wherein water is the liquid protected against evaporation.

**SEE OR SEARCH THIS CLASS, SUBCLASS:**

900, for art collections pertaining to subclasses 1-43.

**SEE OR SEARCH CLASS:**

516, Colloid Systems and Wetting Agents; Subcombinations Thereof; Processes of Making, Stabilizing, Breaking, or Inhibiting, subclasses 9+ for continuous liquid phase colloid systems (e.g., foams, emulsions, suspensions, dispersions) or agents for such systems or making or stabilizing such systems or agents, when generically claimed or when there is no hierarchically superior provision in the USPC for the specifically claimed art.

**44 BLOOD TREATING DEVICE FOR TRANSFUSIBLE BLOOD:**

This subclass is indented under the class definition. Apparatus for treating blood externally of a blooded animal.

**SEE OR SEARCH CLASS:**

435, Chemistry: Molecular Biology and Microbiology, subclass 2 for process of maintaining blood cells in a viable state.

494, Imperforate Bowl: Centrifugal Separators, appropriate subclasses, for apparatus and process for breaking up a mixture of fluids or fluent substances into two or more components by centrifuging within a generally solid-walled, receptacle-like member, and see especially subclasses 16+, for a separator of that class which includes a plurality of miniature bowls (e.g., test tubes) distributed about a rotatable carrier and readily removable therefrom, which latter design of separator, it may be observed, frequently is utilized for separating blood into two or more of its components.

604, Surgery, subclass 507 for method of introducing or removing material from the vasculature system.

**45 Oxygenator:**

This subclass is indented under subclass 44. Apparatus having means for extracorporeal oxygenation of blood.

- SEE OR SEARCH CLASS:  
261, Gas and Liquid Contact Apparatus, appropriate subclasses, especially subclasses 75+ for devices for contacting a gas with a liquid.
- 46 Including integral heat-exchange means:**  
This subclass is indented under subclass 45. Apparatus having means integrally connected with the oxygenator for heating or cooling.
- 47 Bubble or foam producing:**  
This subclass is indented under subclass 45. Apparatus having means for producing a blood-oxygen mixture in the form of a foam or entrained bubbles.
- 48 Membrane:**  
This subclass is indented under subclass 45. Apparatus wherein a membrane (e.g., semipermeable microporous, etc.) separates the blood from the oxygenating medium.
- SEE OR SEARCH CLASS:  
96, Gas Separation: Apparatus, subclasses 4+ for apparatus for selective diffusion of gases (e.g., semipermeable membrane, etc.).  
210, Liquid Purification or Separation, subclasses 634+ for selective separation using septum selective to composition.
- 49 INCLUDING MEANS FACILITATING PART REPLACEMENT OR REPAIR OTHER THAN SOLID, EXTENDED SURFACE, FLUID CONTACT MEANS:**  
This subclass is indented under the class definition. Apparatus having structure disclosed as making it easier to repair or replace parts of the apparatus which deteriorated or is inoperative.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
122, 171+, 631-638, and 211+, for this feature in a solid, extended surface, fluid contact means.
- 50 ANALYZER, STRUCTURED INDICATOR, OR MANIPULATIVE LABORATORY DEVICE:**  
This subclass is indented under the class definition. Apparatus for quantitative or qualitative chemical analysis and laboratory devices.
- SEE OR SEARCH CLASS:  
73, Measuring and Testing, for apparatus for making tests and measurement not otherwise provided for. See particularly subclass 38 for testing illuminating fluids for flash point, vapor pressure, and end point.  
137, Fluid Handling, subclasses 88+ for systems for controlling the mixture of a plurality of fluids in response to the sensing of a condition or characteristic of the mixture, note particularly subclass 93 in which the control is in response to a sensing of a chemical property.  
196, Mineral Oils: Apparatus, subclass 132 and 141 for combinations of apparatus for making a test or measurement and means for controlling a reaction provided for in that class.  
204, Chemistry: Electrical and Wave Energy, subclasses 400 through 435 for apparatus specialized for the determination of a hydrogen ion concentration of solutions.  
324, Electricity: Measuring and Testing, appropriate subclasses for apparatus for testing an electrical property or condition of a material by electrical means, even though the results of the test may be used as an indication of some other physical or chemical property or condition.  
346, Recorders, for recording apparatus, per se.  
374, Thermal Measuring and Testing, subclass 8 for flammability testing; and subclasses 31+ for calorimetry.  
436, Chemistry: Analytical and Immunological Testing, subclasses 1+ for similar processes.  
506, Combinatorial Chemistry Technology: Method, Library, Apparatus, subclasses 33 through 40 for apparatus specially adapted for use in combinatorial chemistry or with a library

- such as in identifying, screening, or creating a library.
- 588, Hazardous or Toxic Waste Destruction or Containment, subclass 260 for the sensing, detecting, or monitoring of hazardous or toxic waste during storage or containment.
- 51 Calorimeter:**  
This subclass is indented under subclass 50. Apparatus wherein the analyzer is a calorimeter; i.e., an analyzer using the measurement of thermodynamic parameters of the material being analyzed as the basis of the analysis.
- SEE OR SEARCH CLASS:  
374, Thermal Measuring and Testing, subclasses 31+ for a calorimeter not involving the determination of the amount of a constituent in a compound or means effecting a chemical reaction other than combustion.
- 52 Chemiluminescent:**  
This subclass is indented under subclass 50. Apparatus comprising means using the measurement of light generated and emitted during a chemical reaction of the material being analyzed as the basis of the analysis.
- SEE OR SEARCH CLASS:  
252, Compositions, subclass 182.11 for chemiluminescent compositions.  
362, Illumination, subclass 34 for chemiluminescent lighting apparatus having light modifying structure.
- 53 Corrosion tester:**  
This subclass is indented under subclass 50. Apparatus for measuring (a) the corrosivity of chemical agents or environments, (b) the corrosion resistance of materials, or (c) the effectiveness of corrosion-inhibiting agents.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
240+, for chemical apparatus constructed of material to resist corrosion.
- 54 Flame ionization detector:**  
This subclass is indented under subclass 50. Apparatus comprising an analyzer using the measurement of a change in the conductivity of a standard, usually hydrogen, flame due to the
- inclusion of another gas or vapor therein to detect the presence or amount of that gas or vapor in a sample.
- 62 Automatic analytical monitor and control of industrial process:**  
This subclass is indented under subclass 50. Apparatus having means for automatically analytically monitoring and controlling a chemical or physical industrial process; e.g., measuring the carbon monoxide concentration in a flue gas and automatically changing the fuel/air ratio based on the measurement, etc.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
63+, and 81+, for automatic analytical system with specified transport means.  
105+, for control element responsive to sensed operation.
- 63 Sample mechanical transport means in or for automated analytical system:**  
This subclass is indented under subclass 50. Apparatus having self-operated analytical systems or components thereof wherein the sample to be analyzed is moved to treating stations by mechanical means.
- 64 Means is turntable (circular):**  
This subclass is indented under subclass 63. Apparatus wherein the mechanical means includes a circular turntable for moving the sample from station to station.
- (1) Note. The presence of a circular turntable for feeding the sample to the analytical system is not included herein.
- 65 Means is conveyor and rack:**  
This subclass is indented under subclass 63. Apparatus wherein the mechanical means includes a conveyor and sample supporting rack.
- 66 Means is moving tape or band:**  
This subclass is indented under subclass 63. Apparatus wherein the mechanical means includes a moving band or tape having sample supports integral therewith.

- 67 With specific analytical program control means:**  
This subclass is indented under subclass 63. Apparatus having means for providing specific analytical program control, including; i.e., command instructions, data correlation, sample location, coding of sample holder, etc.
- 68.1 Means for analyzing liquid or solid sample:**  
This subclass is indented under subclass 50. Apparatus wherein the material to be analyzed is initially in the solid or liquid state, including the analysis of a gas contained in a liquid or solid sample.
- SEE OR SEARCH CLASS:  
73, Measuring and Testing, subclasses 53.01+ for liquid analysis, per se; subclasses 152.18+ for a fluid analysis in testing a borehole, a casing, or a drill rigging wherein the test is not purely electrical or purely magnetic; and in particular subclass 152.42 for determining the relative proportion of fluid constituents wherein the test is not purely electrical or purely magnetic.
- 69 Sorption testing:**  
This subclass is indented under subclass 68.1. Apparatus including means providing for the absorption or adsorption of the material being tested, usually on a solid material.
- 70 Liquid chromatography:**  
This subclass is indented under subclass 69. Apparatus specifically designed or adapted for liquid chromatographic analysis.
- SEE OR SEARCH CLASS:  
73, Measuring and Testing, subclass 61.1 for liquid chromatography testing not involving a chemical reaction.
- 71 With radioactive material:**  
This subclass is indented under subclass 69. Apparatus wherein the material being tested includes a radioactive tracer, including; e.g., apparatus for T-3 and T-4 tests.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
159, for apparatus for radioactive reactant or product.
- 72 Including centrifuge:**  
This subclass is indented under subclass 68.1. Apparatus having centrifugal apparatus.
- SEE OR SEARCH CLASS:  
494, Imperforate Bowl: Centrifugal Separators, appropriate subclasses, for apparatus for breaking up a mixture of fluids or fluent substances into two or more components by centrifuging within a generally solid-walled, receptacle-like member.
- 73 With coagulometer for agglutination, clotting, or for particle (e.g., cell, etc.) counting, or for volume or characteristics determination:**  
This subclass is indented under subclass 68.1. Apparatus for analyzing material by measuring such coagulation phenomena as agglomeration, agglutination, precipitation, clotting, prothrombin, etc., or for particle (e.g., cell, etc.) counting, or volume or characteristics determination.
- 74 Dairy tester:**  
This subclass is indented under subclass 68.1. Apparatus for analysis of dairy products.
- 75 Including titrator:**  
This subclass is indented under subclass 68.1. Apparatus which utilizes titration as a means of chemical analysis.
- 76 Conductimetric type:**  
This subclass is indented under subclass 75. Apparatus having a conductimetric detector which measures ion concentration; e.g., pH, etc., by incremental volumetric additions of a titrant.
- 77 With integrating or differentiating means:**  
This subclass is indented under subclass 76. Apparatus having differentiating or integrating means, usually to extrapolate mathematically to the desired titration end point.
- 78 Including means for pyrolysis, combustion, or oxidation:**  
This subclass is indented under subclass 68.1. Apparatus having means for heating the substance to be analyzed either in the presence or absence of oxygen to cause a chemical reaction; e.g., oxidation, etc., or thermal decomposition of the material.



**79 Biological, chemical, or total oxygen demand (i.e., BOD, COD, TOD):**

This subclass is indented under subclass 78. Apparatus for the analysis of water to determine its oxygen demand.

**80 And means directly analyzing evolved gas:**

This subclass is indented under subclass 78. Apparatus having means for analyzing the gas which is produced as a result of the combustion or pyrolysis.

**81 Automated system with sample fluid pressure transport means:**

This subclass is indented under subclass 68.1. Apparatus having self-operated analytical systems wherein the sample is moved to treating stations principally by fluid pressure.

**82 And means segmenting fluid material:**

This subclass is indented under subclass 81. Apparatus having means for dividing the fluid into segments with bubbles or slugs of separating fluid.

**82.01 Measuring electrical property:**

This subclass is indented under subclass 68.1. Apparatus having means for measuring an electrical property such as detecting the presence of electrical charge carrying substances (e.g., ions, electrolytes, etc.) in the material to be analyzed or detecting the effect of the material to be analyzed on an electrical circuit (e.g., change in voltage, current, electromotive force, potential, impedance, resistance, or conductivity).

**82.02 Resistance or conductivity:**

This subclass is indented under subclass 82.01. Apparatus having means for measuring the resistance or conductivity of the material to be analyzed or having means for detecting an alteration or a change of resistance or conductivity due to the presence of an element (e.g., an ion) in the material to be analyzed.

**82.03 Ion selective electrode:**

This subclass is indented under subclass 82.01. Apparatus having an ion selective or ion sensitive electrode to measure the presence of a particular substance in the material to be analyzed.

- (1) Note. An ion selective chloride electrode will measure only chloride ions as opposed to any negatively charged ion in a solution.

SEE OR SEARCH CLASS:

204, Chemistry: Electrical and Wave Energy, subclasses 416+ for ion selective electrodes, per se.

**82.04 Dissolved gas:**

This subclass is indented under subclass 82.03. Apparatus wherein the ion selective electrode is specific for a dissolved gas; e.g., a pH sensitive electrode or an electrode specific for dissolved carbon dioxide.

**82.05 Measuring optical property by using ultraviolet, infrared, or visible light:**

This subclass is indented under subclass 68.1. Apparatus having means for detecting an optical property of the material to be analyzed.

- (1) Note. Included in this subclass are apparatus which include some sort of referencing scale with which the sample can be compared by the human eye; e.g., graduations on a pipette, a burette, or a color chart.

SEE OR SEARCH THIS CLASS, SUBCLASS:

400 through 429 for structured visual or optical indicators, per se, in the absence of a positive claimed recitation of an indicator with a referencing scale, even though the indicator could be used with a referencing scale.

**82.06 Optode or optrode:**

This subclass is indented under subclass 82.05. Apparatus wherein the means for detecting an optical property is an optode or optrode; i.e., an optical detection apparatus that includes an optical indicator which is set apart from the material to be analyzed by a semipermeable membrane.

- (1) Note. In such apparatus, the substance to be measured in the material to be analyzed permeates through the semipermeable membrane reacting with the indicator to produce an optical response

- that is detected by an optical detector; e.g., a fluorescence detector or a color detector.
- 82.07 Fluorescence:**  
This subclass is indented under subclass 82.06. Apparatus wherein the optode or optrode is such that it produces a fluorescent optical response which is detected by a fluorescence detector.
- 82.08 Fluorescence:**  
This subclass is indented under subclass 82.05. Apparatus having means for measuring fluorescence or luminescence in the material to be analyzed; e.g., a fluorimeter or an oscilloscope.
- 82.09 Absorbance or transmittance:**  
This subclass is indented under subclass 82.05. Apparatus having means for measuring the absorbance or transmittance of the material to be analyzed; e.g., a spectrophotometer, a colorimeter, or a spectro-optical digitizer.
- 82.11 Waveguides:**  
This subclass is indented under subclass 82.05. Apparatus having a waveguide which is in contact with the material to be analyzed and through which light is passed, which light interacts with the material to be analyzed modifying the light which is detected after it leaves the waveguide.
- (1) Note. Such waveguides often have a coating thereon which reacts with a substance in the material to be analyzed to produce a change in the coating which in turn modifies the light passed through the waveguide.
- 82.12 Measuring temperature:**  
This subclass is indented under subclass 68.1. Apparatus having means for measuring the temperature of the material to be analyzed; e.g., a thermocouple.
- 82.13 Measuring pressure:**  
This subclass is indented under subclass 68.1. Apparatus having means for measuring the pressure in the material to be analyzed; e.g., a manometer.
- 83 Means for analyzing gas sample:**  
This subclass is indented under subclass 50. Apparatus wherein the material to be analyzed is initially in the gaseous state.
- (1) Note. The analysis of a gas which is initially contained in a liquid or solid sample is not contained here (see this class, subclasses 68+).
- SEE OR SEARCH CLASS:  
73, Measuring and Testing, subclasses 23.2+ for gas analysis testing not involving a chemical reaction, particularly subclasses 23.35+ for chromatographic testing.
- 84 Breath tester:**  
This subclass is indented under subclass 83. Apparatus having means for testing breath.
- 85 Based on color change:**  
This subclass is indented under subclass 84. Apparatus wherein the analytical measurement is based on a color change.
- 86 Including means reacting gas with color indicator:**  
This subclass is indented under subclass 83. Apparatus having means for reacting the gas with a color indicator.
- 87 Strip indicator:**  
This subclass is indented under subclass 86. Apparatus in the form of a strip.
- 88 Including means for adsorbing or absorbing gas into or onto liquid or solid media:**  
This subclass is indented under subclass 83. Apparatus having means for absorbing or adsorbing the gas sample or that portion to be tested into or onto liquid or solid media.
- 89 Gas chromatography:**  
This subclass is indented under subclass 88. Apparatus wherein the analytical device is a gas chromatographic system.
- SEE OR SEARCH CLASS:  
73, Measuring and Testing, subclass 23.35 for gas chromatographic apparatus not involving chemical reaction.

- 96, Gas Separation: Apparatus, subclasses 101+ for chromatography type apparatus for gas separation.
- 90 With conductimetric detector:**  
This subclass is indented under subclass 88. Apparatus having a conductimetric detector for analyzing the gas sample.
- 91 With photometric detector:**  
This subclass is indented under subclass 88. Apparatus having a photoelectric detector for analyzing the sorbed gas sample.
- 92 With volumetric detector:**  
This subclass is indented under subclass 88. Apparatus having means for making volumetric measurements following the sorption of the gas.
- 93 Including means dividing sample stream into plural parallel segments having diverse treating means and the analytical result compared or combined:**  
This subclass is indented under subclass 83. Apparatus having means for dividing a gas stream into multiple, parallel segments having diverse treating means therefor and means uniting or comparing the analytical results obtained therefrom.
- 94 Combustible gas detector:**  
This subclass is indented under subclass 83. Apparatus for determining the presence or concentration of flammable material in a gas sample, including means for combusting the gas sample and means to detect the presence of, or extent of, the combustion.
- 95 With thermoelectric detector:**  
This subclass is indented under subclass 94. Apparatus including a temperature detecting means of the thermistor type, etc.
- 96 Wheatstone bridge:**  
This subclass is indented under subclass 95. Apparatus having a resistance bridge circuit as a part thereof.
- 97 With specific coating on bridge element:**  
This subclass is indented under subclass 96. Apparatus having a named material coating, usually a catalyst, on a bridge element.
- 98 Analysis based on electrical measurement:**  
This subclass is indented under subclass 83. Apparatus wherein the sample is analyzed by measuring an electrical property thereof.
- 105 CONTROL ELEMENT RESPONSIVE TO A SENSED OPERATING CONDITION:**  
This subclass is indented under the class definition. Apparatus having means for automatically modifying an operation of the system in response to a means sensing an operating condition or change of the same; e.g., automatic shutdown of the reactor responsive to excessive temperature, pressure, etc.
- SEE OR SEARCH CLASS:  
117, Single-Crystal, Oriented-Crystal, and Epitaxy Growth Processes; Non-Coating Apparatus Therefor, subclasses 202+ for non-coating apparatus combined with control element responsive to a sensed operating condition and with means for growing therein-defined single-crystal of all types of materials, including inorganic or organic.
- 106 Responsive to liquid level:**  
This subclass is indented under subclass 105. Apparatus having a control element responsive to a sensed liquid level.
- 107 Control element directly mechanically linked to separate sensor:**  
This subclass is indented under subclass 105. Apparatus wherein the control element is mechanically linked directly to a separate sensor.
- 108 Control element responds proportionally to variable signal from a sensor:**  
This subclass is indented under subclass 105. Apparatus wherein the control element responds proportionally to a variable signal from a sensor.
- 109 Controls heat transfer:**  
This subclass is indented under subclass 108. Apparatus wherein the control element regulates the degree of heat transfer in the system.

- 110 Controls flow rate of a material to or from a contact zone:**  
This subclass is indented under subclass 108. Apparatus wherein the control element regulates the flow rate of material into or out of a contact zone.
- 111 Material is an input to contact zone:**  
This subclass is indented under subclass 110. Apparatus wherein the control element regulates the flow rate of material into the contact zone.
- 112 Control element is fluid pressure sensitive:**  
This subclass is indented under subclass 105. Apparatus wherein the control element is responsive to fluid pressure.
- 113 Pressure-relief valve (e.g., pop-off valve) or check valve:**  
This subclass is indented under subclass 112. Apparatus wherein the fluid pressure sensitive control element is a pressure-relief valve; i.e., pop-off valve, or check valve.
- 114 Control element is a binary responsive valve:**  
This subclass is indented under subclass 105. Apparatus wherein the control element is a binary responsive valve; i.e., a valve having but two operation positions; e.g., open and closed, etc.
- 115 Valve diverts flow from a contact zone:**  
This subclass is indented under subclass 114. Apparatus wherein the operation control is that of bypassing the reaction zone.
- 116 Sensed condition is operating time and control is operation sequencer:**  
This subclass is indented under subclass 105. Apparatus wherein the sensed operating condition is the passage of operating time and the control element is an operation sequencer.
- 117 WITH SAFETY FEATURE:**  
This subclass is indented under the class definition. Apparatus having special means for protecting the operator or the environmental area surrounding the apparatus.
- 118 Preventing opening of closure of pressurized apparatus at unsafe pressure:**  
This subclass is indented under subclass 117. Apparatus wherein the safety feature prevents the opening of a movable or removable closure of the apparatus when the apparatus is at such pressure that the opening of the closure is an unsafe act.
- 119 WITH INDICATING, SIGNALLING, RECORDING, SAMPLING, OR INSPECTION MEANS:**  
This subclass is indented under the class definition. Apparatus having an indicator, signal, recorder, or inspection means.
- 120 FOR DEODORIZING OF, OR CHEMICAL PURIFICATION OF, OR GENERATION OF, LIFE-SUSTAINING ENVIRONMENTAL GAS:**  
This subclass is indented under the class definition. Apparatus for (a) taking the odor out or masking the odor of, or (b) chemical purification of a life-sustaining environmental gas (for breathing) or the chemical generation of the same.
- SEE OR SEARCH THIS CLASS, SUBCLASS:**  
168, for waste gas purifier which usually releases the gas to the atmosphere.
- SEE OR SEARCH CLASS:**  
128, Surgery, subclass 202.26 for inhaling devices having means to regenerate the exhaled air so that it can be breathed again from the same device.
- 121 With means exposing gas to electromagnetic wave energy or corpuscular radiation:**  
This subclass is indented under subclass 120. Apparatus having means for exposing the gas to electromagnetic wave energy (other than ordinary visible light) or corpuscular radiation; e.g., radioactive particles, etc.
- SEE OR SEARCH THIS CLASS, SUBCLASS:**  
113, for apparatus having pop-off valves.

**122 Including solid, extended surface, fluid contact reaction means (e.g., Raschig rings, particulate or monolithic catalyst, etc.):**

This subclass is indented under subclass 120. Apparatus having an extended surface contact reaction means.

SEE OR SEARCH THIS CLASS, SUBCLASS:

177+, 631-638, and 211+, for this structure in a waste gas purifier, in plural stages, and a single stage, respectively.

**123 Including means adding material into environmental gas:**

This subclass is indented under subclass 120. Apparatus having means for dispensing or injecting material into the gas.

**124 And mechanical means creating forced draft at addition site:**

This subclass is indented under subclass 123. Apparatus having a mechanical means forcing an air current at the site wherein the material is introduced into the apparatus.

**125 With material-heating means:**

This subclass is indented under subclass 123. Apparatus having means to increase the temperature of the material.

**126 Material is combusted:**

This subclass is indented under subclass 125. Apparatus wherein the material is burned.

**127 SHOCK OR SOUND WAVE:**

This subclass is indented under the class definition. Apparatus having means for creating sonic energy which is used to initiate or perfect a process. Included herein is apparatus for destroying organisms by the sudden release of high pressure.

**128 Including supersonic or ultrasonic energy generation means:**

This subclass is indented under subclass 127. Apparatus wherein the energy produced travels faster than the speed of sound or it is ultrasonic; i.e., sound waves having frequencies on the order of or greater than 20,000 cps.

**129 CHEMICAL REACTOR:**

This subclass is indented under the class definition. Apparatus for the formation of a product by chemical reaction not otherwise provided for.

SEE OR SEARCH THIS CLASS, SUBCLASS:

105+, for apparatus having means for automatically modifying an operation of the system in response to a means sensing an operating condition or change of the same; e.g., automatic shutdown of the reactor responsive to excessive temperature, pressure, etc.

SEE OR SEARCH CLASS:

156, Adhesive Bonding and Miscellaneous Chemical Manufacture, appropriate subclasses for chemical manufacturing apparatus not elsewhere provided for producing articles of manufacture, and see especially subclasses 345.1-345.55 for differential etching apparatus.

196, Mineral Oils: Apparatus, appropriate subclasses for apparatus for treating mineral oils. Catalytic apparatus, even though employed for carrying out a catalytic-cracking process provided for in Class 208, Mineral Oils: Processes and Products, is classified in this class (422).

204, Chemistry: Electrical and Wave Energy, subclasses 193+ for apparatus employed in carrying out a process provided for in that class, which apparatus is not provided for in any other class.

250, Radiant Energy, subclass 255 for apparatus for testing earth material samples involving, and in name only, chemical or physical separation and an invisible radiation test of the separated material; subclass 281 for ionic separation or analysis apparatus; subclasses 306+ for the inspection of solids or liquids by charged particles and the detection of the particles modified by the solids or liquids; subclasses 336.1+ for apparatus for analyzing material.

- 260, Chemistry of Carbon Compounds, for organic compounds and process of manufacturing the same.
- 401, Coating Implements With Material Supply, subclasses 40+ and 44+ (particularly subclass 47) for a coating implement by means of which diverse materials are applied to a work surface.
- 423, Chemistry of Inorganic Compounds, for inorganic compound and nonmetallic elements and processes for their manufacture involving chemical reaction.
- 435, Chemistry: Molecular Biology and Microbiology, subclasses 283.1+ for apparatus for propagating, treating, or containing living organisms or for fermenting.
- 506, Combinatorial Chemistry Technology: Method, Library, Apparatus, subclasses 33 through 40 for apparatus specially adapted for use in combinatorial chemistry or with a library such as in identifying, screening, or creating a library.
- 129.1 Soap making:**  
This subclass is indented under subclass 129. Apparatus specifically designed for effecting a saponification reaction, i.e., conversion of a higher fatty ester or a natural resin ester into an alcohol and a salt by reacting an alkali with the ester.
- 130 Bench scale:**  
This subclass is indented under subclass 129. Apparatus which is smaller than a pilot reactor and larger than a laboratory apparatus.
- 131 Organic polymerization:**  
This subclass is indented under subclass 129. Apparatus for the chemical production of organic polymers.
- 132 Closed loop:**  
This subclass is indented under subclass 131. Apparatus wherein the reactor is of the closed-loop type; i.e., one wherein substantially all of the reaction mass is continuously recycled during operation.
- 133 Generating foamed plastic:**  
This subclass is indented under subclass 131. Apparatus wherein reactor is designed for the production of a foamed plastic or polymer.  
  
SEE OR SEARCH CLASS:  
366, Agitating, subclasses 162.4+ for a mixing apparatus that introduces materials into a mixing chamber in colliding jets, which materials may be disclosed as reactants for forming plastic foam.
- 134 Including plural sequential reaction stages:**  
This subclass is indented under subclass 131. Apparatus having multiple, serially disposed reaction stages and means for subjecting the reaction mass successively to each of the stages.
- 135 Including reactant agitating means in reaction chamber:**  
This subclass is indented under subclass 131. Apparatus having means located within the reaction chamber for mixing the reaction mass.  
  
SEE OR SEARCH THIS CLASS, SUBCLASS:  
224, for apparatus having internal mixing or stirring means, and see the search notes thereunder.  
  
SEE OR SEARCH CLASS:  
366, Agitating, subclasses 162.4+ for a mixing apparatus that introduces materials into a mixing chamber in colliding jets, which materials may be disclosed as reactants.
- 136 And means rotatably mounting reaction chamber:**  
This subclass is indented under subclass 135. Apparatus having means to rotate the reaction chamber.
- 137 Horizontal reaction chamber with screw or worm agitator:**  
This subclass is indented under subclass 135. Apparatus having a horizontally disposed reaction chamber and a mixing means in the form of a screw or worm.

- 138 With heat exchanger for reaction chamber or reactants located therein:**  
This subclass is indented under subclass 131. Apparatus having means for modifying the ambient temperature disposed within or surrounding the reaction chamber and in heat-transfer contact therewith.
- 139 Fluidized bed:**  
This subclass is indented under subclass 129. Apparatus wherein a bed of fluidizable solid particulate material, which may be a reactant, catalyst, or inert material, is disposed in a reaction chamber for the purpose of carrying out a chemical reaction in the formation of a product and including means for introducing a fluidizing medium into the bed.
- SEE OR SEARCH CLASS:  
34, Drying and Gas or Vapor Contact With Solids, subclasses 576+ for similar fluidized bed structure for drying of particulate material.
- 140 With liquid present:**  
This subclass is indented under subclass 139. Apparatus having a liquid present in the apparatus as either part of the reaction medium or part of the fluidizing medium.
- 141 Plural reaction beds:**  
This subclass is indented under subclass 139. Apparatus comprising multiple reaction beds.
- 142 Sequentially arranged:**  
This subclass is indented under subclass 141. Apparatus wherein the beds are serially disposed and having means for sequentially subjecting the reaction stream to multiple beds.
- 143 Including specific wind box or particulate matter support grid:**  
This subclass is indented under subclass 139. Apparatus wherein the fluidizing medium introducing means includes a particulate matter support grid or a fluidizing inlet manifold chamber; i.e., wind box located within the reaction chamber, either structure being more than nominally recited.
- 144 Including means to strip reaction mass from, or to regenerate, the particulate matter (including fluidized bed regenerators, per se):**  
This subclass is indented under subclass 139. Apparatus having means to remove the reaction mass from or renew the particulate material.
- 145 And means providing flow of particulate matter into or out of reaction chamber:**  
This subclass is indented under subclass 139. Apparatus having means for flowing the particulate matter to or from the reaction chamber.
- 146 With heat exchange means affecting reaction chamber or reactants located therein:**  
This subclass is indented under subclass 139. Apparatus having means for modifying the ambient temperature disposed within or surrounding the reaction chamber and in heat-transfer contact therewith.
- 147 And means mechanically separating and removing particulate bed material from fluid effluent:**  
This subclass is indented under subclass 139. Apparatus having means for mechanically separating and removing the solid particulate material from the reaction product or fluidizing stream; e.g., fluidized bed in combination with upstream filter, cyclone, etc.
- 148 Ammonia synthesizer:**  
This subclass is indented under subclass 129. Apparatus specifically adapted for the chemical synthesis of ammonia; e.g., a high pressure, catalytic ammonia synthesis reactor, etc.
- SEE OR SEARCH CLASS:  
128, Surgery, subclass 202.26 for ammonia medicator.  
205, Electrolysis: Processes, Compositions Used Therein, and Methods of Preparing the Compositions, subclass 552 for electrolytic synthesis of ammonia.
- 149 With means simultaneously carrying out conjugated reactions within single reactor:**  
This subclass is indented under subclass 129. Apparatus having means for simultaneously carrying out conjugated; i.e., sequential reactions within a single reactor; e.g., first reaction stage produces an intermediate product which is fed to a second reaction stage within the

- reactor wherein the intermediate product is converted into the final product, etc.
- 150 Pigment or carbon black producer:**  
This subclass is indented under subclass 129. Apparatus wherein the reactor is specifically adapted for the chemical generation of pigimentary product; e.g., TiO<sub>2</sub>, or carbon black.
- SEE OR SEARCH CLASS:  
204, Chemistry: Electrical and Wave Energy, subclass 173 for chemical preparation of carbon by using an electrostatic field or electrical discharge.  
205, Electrolysis: Processes, Compositions Used Therein, and Methods of Preparing the Compositions, subclasses 615+ for electrolytic synthesis of carbon or other nonmetal elements and subclass 768 for electrolytic treatment of a solid containing free carbon.
- 151 With means injecting quench stream into reaction chamber downstream of reaction site:**  
This subclass is indented under subclass 150. Apparatus having means for injecting a stream of quench fluid into the reaction chamber at a location downstream of the reaction site.
- 152 With particulate product collecting surface and means mechanically removing product therefrom:**  
This subclass is indented under subclass 150. Apparatus having a collecting surface for collecting the particulate material product of the reaction and means associated with the collecting surface for mechanically removing the product therefrom.
- 153 Moving collecting surface:**  
This subclass is indented under subclass 152. Apparatus wherein the collecting surface is mounted for movement during use.
- 154 Rotary collecting surface:**  
This subclass is indented under subclass 153. Apparatus wherein the collecting surface is rotatably mounted.
- 155 Disk or plate:**  
This subclass is indented under subclass 154. Apparatus wherein the collecting surface is a rotatably mounted disk or plate.
- 156 With plural sequential reaction zones or chambers:**  
This subclass is indented under subclass 150. Apparatus having multiple, sequentially arranged reaction zones or chambers.
- 157 With movably or removably mounted plug means for converting reactor from (N) to (N+1) reaction stages:**  
This subclass is indented under subclass 156. Apparatus wherein the plural stages are located in (a) a single reaction chamber or (b) in plural reaction chambers and includes a movably or removably mounted plug means in a reaction chamber for selectively converting the same from (N) to (N+1) reaction zones therein.
- 158 Vapor phase reaction type:**  
This subclass is indented under subclass 150. Apparatus wherein the product is produced by a vapor phase reaction.
- 159 For radioactive reactant or product:**  
This subclass is indented under subclass 129. Apparatus for a radioactive reactant or producing a radioactive product.
- 160 Inorganic sulfur acid or anhydride producing type:**  
This subclass is indented under subclass 129. Apparatus for producing an inorganic sulfur acid or anhydride thereof.
- 161 Acid is final product:**  
This subclass is indented under subclass 160. Apparatus wherein an acid is produced.
- 162 Inorganic hydrator:**  
This subclass is indented under subclass 129. Apparatus wherein water is a chemical reactant.
- 163 Explosives synthesizer:**  
This subclass is indented under subclass 129. Apparatus for producing a product which is an explosive.



- 164 Solid reactant type (i.e., absence of fluid reactants):**  
This subclass is indented under subclass 129. Apparatus specifically designed for nonfluid reactants wherein all of the reactants are in a nonfluid state (i.e., solid); e.g., generation of oxygen from chlorate candles, etc.
- SEE OR SEARCH CLASS:  
280, Land Vehicles, subclasses 728.1+ for air bag devices, or accessories therefor, or subcombinations therefor, for use in land vehicles, which are more than the chemical or physical reactor per se.
- 165 Including ignition means for reactant:**  
This subclass is indented under subclass 164. Apparatus having means for kindling the reactant.
- SEE OR SEARCH CLASS:  
431, Combustion, appropriate subclasses for various types of ignition means.
- 166 Electrically actuated:**  
This subclass is indented under subclass 165. Apparatus wherein the ignition means is electrically actuated.
- 167 Including reactor cooling means surrounding reactor:**  
This subclass is indented under subclass 164. Apparatus having means for cooling the external surface of the reactor.
- 168 Waste gas purifier:**  
This subclass is indented under subclass 129. Apparatus for the modification of a waste gas, prior to its discharge into the atmosphere, by chemical reaction to reduce the pollutant content thereof.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
120+, for apparatus for purifying life-sustaining gas.
- 169 Including means providing sequential purification stages:**  
This subclass is indented under subclass 168. Apparatus having means for subjecting the waste gas to multiple, succeeding purification
- stages, at least one being of the chemical reaction type.
- 170 Plural chemical reaction stages:**  
This subclass is indented under subclass 169. Apparatus having multiple chemical reaction stages.
- 171 Solid, extended surface, fluid contact type:**  
This subclass is indented under subclass 170. Apparatus wherein the reaction stages contain solid extended surface fluid contact reaction means (i.e., means providing a relatively large solid fluid contact surface area within the reaction zone).
- 172 And means downstream of a stage for injecting a reactant into waste gas for interreaction in subsequent stage:**  
This subclass is indented under subclass 170. Apparatus having means located downstream of a reaction stage for injecting a reactant into the waste gas stream for reaction therewith in a subsequent reaction stage (e.g., a catalyst bed for reducing NO<sub>x</sub> in the waste gas followed by a catalyst bed for oxidizing CO in the waste gas, with means for injecting oxygen into the waste gas, as it passes between the two catalyst beds).
- 173 With heat exchanger for reaction chamber or reactants located therein:**  
This subclass is indented under subclass 168. Apparatus having means for heating or cooling the reaction chamber or for heating or cooling the reactants located within the reaction chamber.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
182+, for heat exchange means injecting a combustion fuel into reaction chamber and burning the same.
- 174 Electrical type:**  
This subclass is indented under subclass 173. Apparatus wherein the heat exchange means includes an electrical heater.
- 175 Regenerative heat sink:**  
This subclass is indented under subclass 173. Apparatus wherein the heat-exchange means includes a regenerative heat-sink means; e.g., a low heat capacity mass which absorbs heat

from the hot waste gas and gives up the heat, upon reversal of flow, to colder waste gas to preheat the same upstream of the reaction site, etc.

**176 Including waste gas flow distributor upstream of reaction site and within reaction chamber modifying velocity profile of gas:**

This subclass is indented under subclass 168. Apparatus having waste gas flow distribution means upstream of the purification reaction site and located within the reaction chamber for the purpose of equalizing or otherwise modifying the velocity profile of the waste gas at the upstream end of the reaction site.

SEE OR SEARCH THIS CLASS, SUBCLASS:

183, for claimed mixing means combined with means injecting combustion fuel in the reaction chamber. The mixing means may inherently act as a distribution device.

**177 Including solid, extended surface, fluid contact reaction means; e.g., inert Raschig rings, particulate absorbent, particulate or monolithic catalyst, etc.:**

This subclass is indented under subclass 168. Apparatus including solid extended surface, fluid contact reaction means; i.e., means providing a relatively large solid contact surface area within the reaction zone wherein the large surface area presents multiple reaction sites for contact by the reaction mixture and, thereby, enhance the rate and/or the completeness of the purification reaction, including; e.g., inert Raschig rings, particulate absorbent, etc.

**178 And contact regenerating means or means for cleaning an internal surface of the reaction chamber:**

This subclass is indented under subclass 177. Apparatus having either (a) means for renewing the spent extended surface contact means or (b) means for cleaning an internal surface of the reaction chamber.

**179 Fixed bed with resilient or differential thermal expansion compensating bed support means:**

This subclass is indented under subclass 177. Apparatus wherein the solid extended surface, fluid contact means is in the form of a relatively fixed bed of contact material and including means for supporting the contact bed within the reaction chamber, said support means either itself being resilient or being resiliently mounted to provide for the absorption of mechanical shock or to maintain the contact material within the bed or being specifically designed to compensate for differences in thermal expansion of components in the reaction chamber.

SEE OR SEARCH THIS CLASS, SUBCLASS:

221, for this structure generally in a chemical reactor.

**180 Unitary (i.e., nonparticulate) contact bed (e.g., monolithic catalyst bed, etc.):**

This subclass is indented under subclass 177. Apparatus wherein the extended surface contact means is in the form of a unitary (i.e., nonparticulate) contact bed; e.g., a monolithic honeycomb coated with a catalyst, catalyst-coated metallic screen, etc.

**181 Fixed annularly shaped bed of contact material and means directing gas therethrough substantially perpendicular to longitudinal axis of bed:**

This subclass is indented under subclass 177. Apparatus wherein the extended surface contact means is in the form of a relatively fixed, annularly shaped bed of contact material and including means for directing the flow of waste gas through the contact bed in a direction substantially perpendicular to the longitudinal axis of the contact bed.

**182 Including means injecting combustion fuel into reaction chamber in direct contact with waste gas:**

This subclass is indented under subclass 168. Apparatus having means for injecting combustion fuel into the reaction chamber for direct contact of the fuel itself, or products of combustion thereof, with the waste gas.

**183 And means mixing combustion fuel with waste gas upstream of reaction site:**

This subclass is indented under subclass 182. Apparatus wherein the fuel-injecting means includes means for injecting the fuel into the waste gas stream and for mixing the fuel therewith at a location upstream of the reaction site.

**184.1 For chemically destroying or disintegrating solid waste, other than burning alone:**

This subclass is indented under subclass 129. Apparatus for destroying or breaking up solid waste utilizing a chemical reaction, other than burning alone.

- (1) Note. This subclass is not intended to contain an apparatus related to composting. Such matter is provided for elsewhere. See Search Note below.

## SEE OR SEARCH CLASS:

- 4, Baths, Closets, Sinks, and Spittoons, subclasses 222+ for subject matter of that class combined with disinfecting means.
- 241, Solid Material Comminution or Disintegration, subclasses 38+ for apparatus of that class combined with means for applying a fluid to the material being worked upon.
- 435, Chemistry: Molecular Biology and Microbiology, subclasses 290.1+ for composting apparatus.

**185 For chemical recovery of chemicals from waste paper making liquor:**

This subclass is indented under subclass 129. Apparatus for chemically recovering chemicals for waste kraft or black liquors, e.g., waste liquor from a paper-making process.

## SEE OR SEARCH CLASS:

- 162, Paper Making and Fiber Liberation, subclasses 232+ for paper making apparatus.

**186 With means applying electromagnetic wave energy or corpuscular radiation to reactants for initiating or perfecting chemical reaction:**

This subclass is indented under subclass 129. Apparatus having means for applying electromagnetic wave energy (other than visible light)

or corpuscular radiation; e.g., radioactive particles, etc., to the reactants for initiating or perfecting the reaction.

## SEE OR SEARCH THIS CLASS, SUBCLASS:

- 21, and 22+, for process of using electromagnetic radiation for disinfecting, deodorizing, preserving, or sterilizing.
- 121, for apparatus for deodorizing, chemically purify, or generating a life sustaining environment (e.g., air, etc.)

## SEE OR SEARCH CLASS:

- 34, Drying and Gas or Vapor Contact With Solids, subclasses 245+ and 266+ for processes and apparatus involving subjecting material to electrical or selected radiant energy.
- 134, Cleaning and Liquid Contact With Solids, subclass 1 for processes of cleaning or liquid contact with solids, including application of electrical radiant or wave energy to work.
- 204, Chemistry: Electrical and Wave Energy, appropriate subclasses for process which employ the apparatus of this subclass (Class 422, subclasses 186+).
- 210, Liquid Purification or Separation, subclasses 748.01 through 748.2 for liquid purification or separation processes utilizing electrical or wave energy directly applied to liquid or material being treated.
- 219, Electric Heating, subclasses 600+ for inductive heating, subclasses 678+ for microwave heating, and subclasses 764+ for capacitive dielectric heating.
- 373, Industrial Electric heating Furnaces, subclasses 18+ for plasma or combination furnaces; and subclasses 60+ for electric use furnaces.

**186.01 Magnetic:**

This subclass is indented under subclass 186. Subject matter including means establishing a magnetic field in which the chemical reaction takes place.

## SEE OR SEARCH CLASS:

- 204, Chemistry: Electrical and Wave Energy, subclasses 155 and 156 for corresponding processes; and subclass

- 193 for apparatus establishing a permanent or nonvarying magnetic field in which the reaction takes place.
- 210, Liquid Purification or Separation, subclasses 222+ for separators for separating solids from a liquid by magnetic action.

**186.02 Object protection:**

This subclass is indented under subclass 186.01. Subject matter specialized for the protection of objects by the application of an electromagnetic field.

## SEE OR SEARCH CLASS:

- 204, Chemistry: Electrical and Wave Energy, subclasses 196.01+ for electrolytic object protection apparatus.

**186.03 With electrical discharge:**

This subclass is indented under subclass 186.01. Subject matter including in addition to the electromagnetic field means to give an electric discharge.

## SEE OR SEARCH THIS CLASS, SUBCLASS:

- 186.2+, for chemical reactor apparatus employing only an arc or spark discharge means.

## SEE OR SEARCH CLASS:

- 204, Chemistry: Electrical and Wave Energy, subclass 156 for corresponding processes.

**186.04 Electrostatic field or electrical discharge:**

This subclass is indented under subclass 186. Subject matter wherein an electrostatic field or electric discharge is included in the reaction zone.

## SEE OR SEARCH THIS CLASS, SUBCLASS:

- 186.3, for apparatus employing an electromagnetic field in addition to the electric discharge.

## SEE OR SEARCH CLASS:

- 96, Gas Separation: Apparatus, subclasses 15+ for electric or electrostatic field separation apparatus for gas separation not involving conversion of

- constituents to other compounds by chemical reaction.
- 204, Chemistry: Electrical and Wave Energy, subclasses 164+ for corresponding processes.
- 313, Electric Lamp and Discharge Devices, appropriate subclasses for electrical space discharge devices, including those for producing arcs or sparks.
- 315, Electric Lamp and Discharge Devices, Systems, appropriate subclasses for systems for supplying electric energy to electric space discharge devices of the gas vapor ionization type; especially subclass 111 where the discharge device includes means to supply a fluent material to the discharge space.

**186.05 Treating surface of solid substrate:**

This subclass is indented under subclass 186.04. Subject matter wherein the material being treated is a nonfluent solid and the treatment involves only the surface of the solid.

## SEE OR SEARCH CLASS:

- 118, Coating Apparatus, subclasses 620+ for coating apparatus including means to apply electrical and/or radiant energy to a workpiece and/or coating material.
- 427, Coating Processes, subclasses 457+ for coating processes including direct application of electric, magnetic, or wave energy to the workpiece.

**186.06 Surface is metal:**

This subclass is indented under subclass 186.05. Subject matter wherein the solid is a metal.

- (1) Note. Particularly included in this subclass is apparatus for ion nitriding (or other ion bombardment treatment) of metal workpieces.

## SEE OR SEARCH CLASS:

- 148, Metal Treatment, appropriate subclasses for processes of heat treatment of solid metal to modify or maintain the internal physical structure (i.e.,

microstructure) or chemical property of metal. Particularly, see subclass 222 for processes of carburizing or nitriding of metal from an external source of carbon or nitrogen and subclass 239 for a process of ion implantation of solid metal. Also, see Class 148, subclasses 224, 525, and 565 for other processes which use electromagnetic wave energy, plasma, electron arcs, or beams to treat solid metal for purposes of that class.

**186.07 Ozonizers:**

This subclass is indented under subclass 186.04. Subject matter specialized for the production of ozone.

**SEE OR SEARCH CLASS:**

128, Surgery, subclass 202.25 for ozone inhalers.

204, Chemistry: Electrical and Wave Energy, subclass 176 for corresponding processes.

**186.08 With preparatory or product-treating means:**

This subclass is indented under subclass 186.07. Subject matter including means for the preparatory treatment of the material fed to the ozonizer, or means to treat the product thereof.

- (1) Note. Combination of an ozonizer and apparatus for the application of the ozone to material to be sterilized or otherwise treated are not here included unless not otherwise provided for in other classes.

**186.09 With drying means:**

This subclass is indented under subclass 186.08. Subject matter in which the treatment means includes means to remove water or water vapor.

**186.1 With filtering or particle removal means:**

This subclass is indented under subclass 186.08. Subject matter wherein the treatment means includes means to remove suspended solid or liquid particles.

**186.11 With cooling, compression, condensation, or liquefying means:**

This subclass is indented under subclass 186.08. Subject matter wherein the treatment means effects a cooling, compression, condensation, or liquefying of the gas being treated or the treated gas.

**186.12 With subsequent use means:**

This subclass is indented under subclass 186.07. Subject matter including means for the application of the ozone to the object or material to be sterilized or otherwise treated.

**SEE OR SEARCH CLASS:**

210, Liquid Purification or Separation, subclass 760 for processes of that class utilizing ozone.

**186.13 With electrode moving means:**

This subclass is indented under subclass 186.07. Subject matter including means to move one or more of the electrodes.

**186.14 With fluent reactant flow control means:**

This subclass is indented under subclass 186.07. Subject matter including means to control the direction or amount of a fluent reactant (e.g., oxygen, containing gas or liquid) flowing to or through the reaction zone.

- (1) Note. Such a means is frequently disclosed as one or more valves.

**186.15 With current control or special electrical supply means:**

This subclass is indented under subclass 186.07. Subject matter including means to control the supply of electrical current to the treatment zone or which includes special electrical current supply means.

**SEE OR SEARCH CLASS:**

323, Electricity: Power Supply or Regulation Systems, appropriate subclasses for miscellaneous systems for controlling the current and/or voltage in a single circuit.

**186.16 With pulse generating means:**

This subclass is indented under subclass 186.15. Subject matter wherein the voltage, current, frequency, or polarity of the power

supply is changed regularly and deliberately overtime.

- (1) Note. Simple sine wave AC current is not included in this subclass.

**186.18 Cylindrical electrode:**

This subclass is indented under subclass 186.07. Subject matter in which one or more of the electrodes of the ozonizer is cylindrical.

**186.19 With heating or cooling means:**

This subclass is indented under subclass 186.18. Subject matter in which the ozonizer is provided with a heating or cooling means.

**186.2 With heating or cooling means:**

This subclass is indented under subclass 186.07. Subject matter including means to cool or heat the ozonizer.

SEE OR SEARCH THIS CLASS, SUBCLASS:

186.08, for the combinations of an ozonizer and a preparatory or subsequent cooling means.

**186.21 Arc or spark discharge means:**

This subclass is indented under subclass 186.04. Subject matter specialized for the formation of the spark or arc type of electrical discharge.

SEE OR SEARCH CLASS:

313, Electric Lamp and Discharge Devices, appropriate subclasses for electric space discharge devices including those for producing arcs or sparks.

315, Electric Lamp and Discharge Devices: Systems, appropriate subclasses for electric space discharge devices of the gas or vapor type; note especially subclasses 111.01+ where the discharge device includes means to supply fluent material to the discharge device.

373, Industrial Electric Heating Furnaces, subclasses 60+ for arc furnaces in general.

**186.22 With electrode or reaction space heating or cooling means:**

This subclass is indented under subclass 186.21. Subject matter including means to heat or cool the arc chamber or a portion thereof or one or more of the electrodes.

SEE OR SEARCH THIS CLASS, SUBCLASS:

186.25, for combinations of arc or spark discharge means with heating or cooling means for preparatory treatment of the material fed to the chamber, or of the product produced thereby.

**186.23 With preparatory or product-treating means:**

This subclass is indented under subclass 186.21. Subject matter including in addition to be arc or spark discharge means, a preparatory treatment means for the materials added to the arc or spark discharge chamber or means for treatment of the products from such chamber.

**186.24 With nitrogen fixation means:**

This subclass is indented under subclass 186.23. Subject matter including means for separating nitrogen as nitrogen compounds from the other components of air.

**186.25 With cooling or pressurizing means:**

This subclass is indented under subclass 186.23. Subject matter including means for cooling or increasing the atmospheric pressure in the arc or spark chamber.

**186.26 With electrode moving means:**

This subclass is indented under subclass 186.21. Subject matter including means to move one or more of the electrodes.

**186.27 With current control means:**

This subclass is indented under subclass 186.26. Subject matter including means to control the electrical current.

SEE OR SEARCH CLASS:

323, Electricity: Power Supply or Regulation Systems, appropriate subclasses for miscellaneous systems for controlling the current and/or voltage in a single circuit.

**186.28 With current control means:**

This subclass is indented under subclass 186.21. Subject matter including means to control the electrical current.

## SEE OR SEARCH CLASS:

323, Electricity: Power Supply or Regulation Systems, appropriate subclasses for miscellaneous systems for controlling the current and/or voltage in a single circuit.

**186.29 With RF input means:**

This subclass is indented under subclass 186.04. Subject matter wherein the chemical reaction occurs under the influence of a radiant (e.g., microwave) electromagnetic field or "high frequency" AC current having a frequency greater than 60 KH.

## SEE OR SEARCH CLASS:

219, Electric Heating, subclasses 600+ for inductive heating, subclasses 678+ for microwave heating, and subclasses 764+ for capacitive dielectric heating.

**186.30 With ultraviolet radiation generating means:**

This subclass is indented under subclass 186. Subject matter utilizing wave energy in the ultraviolet range.

- (1) Note. The ultraviolet portion of the spectrum is considered to include 4,000-40,000 Å° or 10HZ.<sup>15-1017</sup>

**187 Combined:**

This subclass is indented under subclass 129. Apparatus combined with the subject matter of other class(es) not specifically provided for in this class.

**198 Including heat exchanger for reaction chamber or reactants located therein:**

This subclass is indented under subclass 129. Apparatus having means for heating or cooling the reaction chamber or the reaction mass located within the chamber.

- (1) Note. Excluded from this and indented subclasses are heat-exchange means which generate a direct contact heat-

exchange medium in situ (e.g., a fuel gas burner wherein the flame is produced within the reaction chamber, a catalyst bed used to generate heat via the maintenance of an autothermic reaction, etc.).

**199 Electrical type:**

This subclass is indented under subclass 198. Apparatus having an electrical heating means.

**200 Indirect heat-exchange tube within reaction chamber with a nonreactant heat-exchange fluid passing therethrough:**

This subclass is indented under subclass 198. Apparatus comprising an indirect heat-exchange means located within the reaction chamber and being in the form of a tube having nonreactant heat-exchange fluid pass therethrough, (e.g., a steam coil in the reaction chamber mass, etc.).

**201 Tube and shell type:**

This subclass is indented under subclass 200. Apparatus in the form of a shell having inlet and outlet manifolds with plural tubes connected therebetween.

**202 Heat-exchange jacket surrounding reaction chamber:**

This subclass is indented under subclass 198. Apparatus wherein the heat exchanger is in the form of a heat-exchange jacket surrounding at least a portion of the exterior of the reaction chamber.

**203 Including fluid-transfer means connecting chamber to heat-exchange jacket:**

This subclass is indented under subclass 202. Apparatus having fluid-transfer means connecting the reaction chamber and the heat-exchange jacket whereby reactants or products from the reaction chamber are used as a heat-transfer medium.

**204 Means associated with jacket providing combustion gas as heat-exchange medium:**

This subclass is indented under subclass 202. Apparatus comprising means associated with the jacket using a combustion gas as the heat-exchange medium within the jacket.

**205 Including baffle or stirring means disposed within jacket or chamber, the baffle means**

- within chamber connected directly to wall thereof:**  
This subclass is indented under subclass 202. Apparatus comprising baffle or stirring means located within the heat-exchange jacket or the reaction chamber wherein the baffle means located within the chamber are attached directly to the wall of the chamber.
- 206 Regenerative heat sink:**  
This subclass is indented under subclass 198. Apparatus wherein the heat-exchanger includes a regenerative heat-sink means; e.g., a low heat capacity mass which adsorbs heat from hot reaction products and gives up heat to colder reactants to preheat them, etc.
- 207 Means injecting internal quench stream into reaction stream downstream of reaction stage:**  
This subclass is indented under subclass 198. Apparatus wherein the heat exchanger includes means located within the reaction chamber for injecting a quench stream into the reaction stream at a location downstream of the reaction stage.
- 208 Apparatus operates at positive pressure:**  
This subclass is indented under subclass 198. Apparatus wherein the apparatus operates a pressure above that of the ambient environment.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
242, for positive pressure reactor, per se.  
295, for physical type positive pressure reactor.
- 209 Including means rotating reaction chamber during use:**  
This subclass is indented under subclass 129. Apparatus having means for revolving the reaction chamber during use.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
270, for a rotating container in a liquid-solid contact apparatus.
- SEE OR SEARCH CLASS:  
366, Agitating, subclasses 219+ for agitating by use of a rotating receptacle.
- 432, Heating, subclasses 103+ for a tumbler rotary-drum furnace.
- 210 And means wiping or scraping interior surface of reaction chamber:**  
This subclass is indented under subclass 209. Apparatus having means contacting the inner surface of the reactor for removing material from the surface as a result of the contact.
- 211 Including solid, extended surface, fluid contact reaction means; e.g., inert Raschig rings, particulate absorbent, particulate or monolithic catalyst, etc.:**  
This subclass is indented under subclass 129. Apparatus including solid extended surface fluid contact reaction means, i.e., means providing a relatively large solid contact surface area within the reaction zone wherein large surface area presents multiple reaction sites for contact by the reaction mixture and, thereby, enhance the rate and/or the completeness of the reaction, including; e.g., inert Raschig rings, particulate absorbent, etc.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
122, for subject of this subclass for use in a life-sustaining gas treating apparatus.  
171, for plural and 177 for single structures of this type used in a waste gas purifier.  
631 through 638 for plural structures of this type.
- 212 With means removing and recovering product from extended surface contact material:**  
This subclass is indented under subclass 211. Apparatus having means for removing and reclaiming product material from the extended surface contact material.
- 213 Particulate contact material type and means providing flow of particulate material into or out of reaction chamber with reactants or products:**  
This subclass is indented under subclass 211. Apparatus wherein the solid extended surface contact means is particulate material and the apparatus has means for flowing the material into or out of the reaction chamber along with reactants or products, respectively.



**214 Transfer line type reaction chamber:**

This subclass is indented under subclass 213. Apparatus wherein the reaction chamber is in the form of a transfer line reactor; i.e., a relatively narrow reaction chamber having a relatively high length-to-diameter ratio and means to flow the particulate contact material out of the reaction chamber with the reaction product stream.

**215 And internal mixing means:**

This subclass is indented under subclass 213. Apparatus having means within the reaction chamber for maintaining the mixture of the material and reaction medium in a mixed or agitated state.

**216 Compact bed of particulate, fluid contact material and means providing gravity flow of material within bed:**

This subclass is indented under subclass 211. Apparatus wherein the extended surface, fluid contact material is in the form of a compact bed of particulate material and having means providing flow of the material by gravity inside the bed.

**217 And means upstream of extended surface, fluid contact means removing particulate impurities from reactant stream:**

This subclass is indented under subclass 211. Apparatus having means located before the contact means for taking particulate impurities from the reactant feed stream.

**218 Fixed annularly shaped bed of contact material and means directing reactant there-through substantially perpendicular to longitudinal axis of bed:**

This subclass is indented under subclass 211. Apparatus having a fixed annularly shaped bed of contact material and means directing the flow of the reaction stream through the bed substantially perpendicular to the longitudinal axis of the contact bed.

**219 And means loading contact material into, or unloading contact material from, reactor or means providing internal contact material reservoir:**

This subclass is indented under subclass 211. Apparatus having means for either (a) loading the solid fluid contact material into the reaction

chamber, (b) unloading the same from the reaction chamber, or (c) providing a contact material reservoir within the reaction chamber.

**220 And reactant flow distributor upstream of contact means and within reaction chamber modifying velocity profile of reactant flow:**

This subclass is indented under subclass 211. Apparatus having reactant flow distributing means located within the reaction chamber and before the contact means for equalizing or otherwise modifying the velocity profile of the reactant stream at upstream contact face of the contact means.

**221 Fixed contact bed type with resilient or differential thermal expansion compensating bed support means:**

This subclass is indented under subclass 211. Apparatus wherein the solid extended surface, fluid contact means is in the form of a relatively fixed bed of contact material and including means for supporting the contact bed within the reaction chamber, said support means either itself being resilient or being resiliently mounted to provide for the absorption of mechanical shock or to maintain the contact material within the bed or being specifically designed to compensate for differences in thermal expansion of components in the reaction chamber.

SEE OR SEARCH THIS CLASS, SUBCLASS:

179, for this structure in a waste gas purifier.

**222 Unitary (i.e., nonparticulate) contact bed (e.g., monolithic catalyst bed, etc.):**

This subclass is indented under subclass 211. Apparatus wherein the extended surface contact means is in the form of a unitary (i.e., nonparticulate) contact bed (e.g., a monolithic honeycomb coated with a catalyst, catalyst coated metallic screen, etc.)

SEE OR SEARCH THIS CLASS, SUBCLASS:

180, for this structure in a waste gas purifier.

- 223 With contact material regenerating means, per se, or combined with reactor:**  
This subclass is indented under subclass 211. Apparatus having means for renewing the contact material, the means being recited either, per se, or in combination with a chemical reactor utilizing the contact material.
- 224 Including internal mixing or stirring means:**  
This subclass is indented under subclass 129. Apparatus having means located within the reaction chamber for mixing or stirring the reaction mass therein.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
131, for agitating means in an organic polymerization reactor.
- SEE OR SEARCH CLASS:  
366, Agitating, appropriate subclasses for agitators consisting of a receptacle and stirrer.
- 225 Mechanical type stirring means:**  
This subclass is indented under subclass 224. Apparatus wherein the mixing and stirring means includes a mechanical-type stirrer.
- 226 In positive pressure reactor:**  
This subclass is indented under subclass 225. Apparatus wherein pressure is maintained greater than the ambient pressure.
- 227 Including a draft tube for internal recirculation:**  
This subclass is indented under subclass 225. Apparatus including a draft tube (i.e., a longitudinally extending tubular means open at both ends thereof) located within the reaction chamber and providing, in combination with the stirring means, fluid recirculation within the reaction chamber via fluid movement through the tube.
- 228 Including flow directing baffle attached directly to reaction chamber wall:**  
This subclass is indented under subclass 225. Apparatus wherein the stirring means includes a flow directing baffle directly attached to the reaction chamber wall.
- 229 Longitudinally extending spiral stirring means:**  
This subclass is indented under subclass 225. Apparatus wherein the stirring means is in the shape of a spiral extending in a direction parallel to the major axis of the reaction chamber.
- 230 Thermosyphon or differential density mixing means; e.g., means internally recycling reaction mass via differential density pumping, etc.:**  
This subclass is indented under subclass 224. Apparatus having thermosyphon or differential density type mixing means; e.g., means internally recycling the reaction mass via differential density pumping through a draft tube, etc.
- 231 Gas sparger type mixing means submerged in liquid reactant:**  
This subclass is indented under subclass 230. Apparatus wherein a gas sparger type mixing means is submerged in a liquid reactant.
- 232 Including solid reactant and means charging solids into, or discharging solids from, reaction chamber:**  
This subclass is indented under subclass 129. Apparatus wherein the reactants include a solid particulate material and means for charging the solids to, or discharging the same from, the reaction chamber.
- 233 Having both charge and discharge means along with means conveying solids therebetween located within reaction chamber:**  
This subclass is indented under subclass 232. Apparatus having means for conveying the solids into, through, and out of the reaction chamber.
- 234 Including external recycle loop:**  
This subclass is indented under subclass 129. Apparatus having means located outside of the reaction chamber for recycling at least a portion of the product stream or reaction mass to the reaction chamber.
- 235 And means heating or cooling loop or reaction mass located therein:**  
This subclass is indented under subclass 234. Apparatus having means for changing the temperature of the reaction mass within the external recycle loop.

**236 Including means separating reaction chamber into plural reactant-containing compartments and means moving reactant therebetween:**

This subclass is indented under subclass 129. Apparatus having means dividing the reaction chamber into plural distinct reactant-containing compartments and means for transporting the reactants, or permitting such transportation of the reactants, between the compartments.

**237 Movable mounted container-type separating means and means moving same:**

This subclass is indented under subclass 236. Apparatus wherein the separating means includes a movably mounted container having means for moving the same.

**238 Solid reactant containing perforated or porous container-type separating means:**

This subclass is indented under subclass 236. Apparatus wherein one reactant is a solid material and the separating means includes a perforated or porous container for containing the reactant.

**239 Reaction chamber includes at least one perforated, porous, or semipermeable wall and is adapted for holding solid reactant:**

This subclass is indented under subclass 129. Apparatus wherein the reaction chamber comprises at least one perforated or porous wall and is designed for holding a solid reactant.

**240 Including specific material of construction:**

This subclass is indented under subclass 129. Apparatus wherein specific materials of construction for the reactor or components thereof are recited.

**241 Reactor liner:**

This subclass is indented under subclass 240. Apparatus having a liner of a specified material of construction for the reactor chamber.

**242 Positive pressure type:**

This subclass is indented under subclass 129. Apparatus having means for operating the same above the ambient pressure.

SEE OR SEARCH THIS CLASS, SUBCLASS:

208, for apparatus having heat exchanger operating at a positive pressure.

226, for positive pressure apparatus with mixing means.

295, for physical type positive pressure reactor.

**243 PHYSICAL TYPE APPARATUS:**

This subclass is indented under the class definition. Apparatus for carrying out a physical process.

SEE OR SEARCH THIS CLASS, SUBCLASS:

105+, for apparatus having means for automatically modifying an operation of the system in response to a means sensing an operating condition or change of the same; e.g., automatic shutdown of the reactor responsive to excessive temperature, pressure, etc.

**244 Including serially disposed vaporizing heating means (sublimator) and solid material deposition means maintained at a temperature lower than said heating means (condenser):**

This subclass is indented under subclass 243. Apparatus having serially arranged vaporizing heating means and solid material depositing means being maintained at a temperature lower than the heating means.

**245.1 Crystallizer:**

This subclass is indented under subclass 243. Non-coating apparatus for producing non-metal, non-glass crystalline material, with no clear intent to provide a shaped article, and with no intent to grow single-crystal.

(1) Note. This subclass provides for the apparatus which operates to crystallize by only a physical (i.e., not chemical) reaction.

(2) Note. Apparatus which involve removing heat to solidify a material are generally provided for elsewhere, for example in Class 62.

- (3) Note. Apparatus for coating or molding are generally provided for elsewhere, for example in Classes 117, 118, 164, 249, or 425.
- (4) Note. Apparatus which involve evaporating which causes crystallizing or precipitating, and involves no significant chemical change, are generally provided for in Class 159.

**SEE OR SEARCH THIS CLASS, SUB-CLASS:**

- 105+, for non-coating crystallizing apparatus which further includes a means for automatically modifying an operation thereof in response to a means sensing an operating condition or a change of the same.
- 129+, for non-coating crystallization apparatus which includes means for a chemical reaction.

**SEE OR SEARCH CLASS:**

- 62, Refrigeration, for apparatus peculiar to removing heat from a substance and apparatus peculiar to handling the resultant product, especially subclasses 123+ for apparatus having means to separate a constituent of a liquid mixture by cooling it and subclasses 317+ for apparatus having a filter or gravitational separator for the fluid cooled by refrigeration means.
- 65, Glass Manufacturing, for apparatus making glass, especially subclasses 187+ and 193+ for means for pulling glass from a melt.
- 117, Single-Crystal, Oriented-Crystal, and Epitaxy Growth Processes; Non-Coating Apparatus Therefor, subclasses 200+ for processes and non-coating apparatus for growing therein-defined single-crystal of all types of materials, including inorganic or organic.
- 118, Coating Apparatus, for apparatus for applying or obtaining a surface coating on a base, where it is not provided for in another class. See the Class 118 definition for guidance in the placement of coating apparatus art.

- 127, Sugar, Starch, and Carbohydrates, subclasses 15+ and 17+ for apparatus for crystallizing or treating crystals of class-defined materials.
- 159, Concentrating Evaporators, for apparatus for evaporating, including those which cause crystallization, absent defined vapor recovery means (except energy recovery), and absent significant chemical changes.
- 164, Metal Founding, subclasses 139+ for apparatus for molding non-semiconductor metal.
- 196, Mineral Oils: Apparatus, subclass 14.5 for apparatus to separate wax which may include chilling to solidify.
- 210, Liquid Purification or Separation, for apparatus for crystallizing where the primary intent is a Class 210 defined purpose. Since references are placed according to disclosed intent, cross-referencing is required where secondary intent is disclosed or evident.
- 249, Static Molds, appropriate subclasses for a static mold of fluent material not combined with a diverse art device.
- 425, Plastic Article or Earthenware Shaping or Treating: Apparatus, subclasses 6+ for apparatus for making non-metal, non-glass powders, which may be crystalline, from liquid by means dividing or comminuting and allowing the liquid to solidify while in particulate form of a desired size or shape but with no shaping surface; subclass 77 for ultra-high-pressure generating apparatus; and appropriate subclasses for dynamic molding apparatus for other than metal or glass.

**250.1 Crucible-free zone refiner:**

This subclass is indented under subclass 245.1. Apparatus having a refining zone which is free of contact with a solid shaping surface such as a crucible (wall).

**251 Including means separating and conveying crystals to a melting zone:**

This subclass is indented under subclass 245.1. Apparatus having means for separating and transporting crystals to the melting zone.

- 252 Hydraulic classifier with crystallizer:**  
This subclass is indented under subclass 245.1. Apparatus having hydraulic means to maintain a suspension for classification of crystals within the apparatus.
- 253 Including feed compartment for introducing nutrient:**  
This subclass is indented under subclass 245.1. Apparatus having a feed section within crystallizer vessel for introducing a solute (per se, or in solution) during crystallization.
- 254 Movable crystallizer or scraping means:**  
This subclass is indented under subclass 245.1. Apparatus having a movable crystallizer or scraping means acting on the wall of the crystallizer.
- 255 Means separating or dissolving a material constituent:**  
This subclass is indented under subclass 243. Apparatus having means to segregate or liquefy at least one component of the matter being treated.
- (1) Note. The apparatus classified here carries out a process which generally leaves an insoluble residue.
- SEE OR SEARCH CLASS:
- 34, Drying and Gas or Vapor Contact With Solids, has drying processes and apparatus which remove extraneous liquids from solids even though there is subsequent condensation or recovery of vapors and also drying processes and apparatus in which solids are contacted with liquids to promote drying.
- 75, Specialized Metallurgical Processes, Compositions for Use Therein, Consolidated Metal Powder Compositions, and Loose Metal Particulate Mixtures, appropriate subclasses for processes using nonmetallic material which is liquid under standard conditions.
- 100, Presses, subclass 90 for devices for pressing combined with means for separating materials.
- 127, Sugar, Starch, and Carbohydrates, subclasses 3+ for apparatus for leaching or dissolving sacchariferous material in the manufacture of sugar, starch, or carbohydrates.
- 134, Cleaning and Liquid Contact With Solids, subclass 43 is the generic place for apparatus for contacting a solid with a liquid. See the definition and notes to that class.
- 202, Distillation: Apparatus, subclasses 168 through 170 for leaching or extracting apparatus combined with distillation apparatus.
- 206, Special Receptacle or Package, subclass .5 for infusion receptacles or packages.
- 209, Classifying, Separating, and Assorting Solids, subclasses 155+ for fluid suspension in a liquid; and subclasses 423 to 465 for stratification involving liquid treatment which may include treatment of the solids with a liquid.
- 210, Liquid Purification or Separation, subclasses 177+ and 198.1+ for apparatus for liquid purification or separation which involves the addition of a treating liquid and subclass 167.11 for liquid purification or separation apparatus comprising a closed circulating system for a swimming pool or spa with means to add a treating material.
- 239, Fluid Sprinkling, Spraying, and Diffusing, subclasses 310+ for dissolvers and mixers combined with a fluid discharging element.
- 252, Compositions, subclasses 625+ for radioactive compositions and methods of making them involving a mere blending of materials.
- 266, Metallurgical Apparatus, subclass 101 for apparatus for metallurgical leaching and precipitating; subclasses 161+ and 168+ for extracting metal apparatus.
- 366, Agitating, for processes and apparatus for mere agitation of a solid in a liquid.
- 401, Coating Implements With Material Supply, subclasses 40+ and 44+ for a coating implement having diverse materials which are mixed therein prior to application to a work surface.

- 426, Food or Edible Material: Processes, Compositions, and Products, subclasses 77+ for food infusion type containers, per se, or containing edible material.
- 256 Liquid-liquid contact means:**  
This subclass is indented under subclass 255. Apparatus comprising liquid-liquid contact means for removing a constituent from a liquid.
- SEE OR SEARCH CLASS:  
196, Mineral Oils: Apparatus, appropriate subclasses, especially subclass 14.52 for apparatus limited to the extraction of mineral oils.  
210, Liquid Purification or Separation, subclasses 198.1+ for apparatus for purifying liquid with means to add a treating material.
- 257 Including pulsator, adjustable plates, or plural inlets; e.g., spraying, etc.:**  
This subclass is indented under subclass 256. Apparatus having pulsating means or adjustable plates or plural orifice inlets for the same liquid.
- 258 Including rotating chamber or rotating member within chamber; e.g., mixer-settler, etc.:**  
This subclass is indented under subclass 256. Apparatus having a rotatable containing means or a rotating means within the containing means.
- SEE OR SEARCH CLASS:  
494, Imperforate Bowl: Centrifugal Separators, subclass 22, for a separator of that class and the introduction thereto of differing weight fluids for counter current flow therein.
- 259 Having rotating member within chamber:**  
This subclass is indented under subclass 258. Apparatus wherein the rotating means is located within the containing means.
- 260 Including heating and cooling means:**  
This subclass is indented under subclass 256. Apparatus having means for both elevating and lowering the temperature of the material being treated.
- 261 Liquid-solid contact means:**  
This subclass is indented under subclass 255. Apparatus having means for liquid-contacting a solid or vice versa.
- SEE OR SEARCH CLASS:  
134, Cleaning and Liquid Contact With Solids, subclasses 43+ for the generic place for apparatus for contacting a solid with a liquid. See the definition and notes to that class.  
210, Liquid Purification or Separation, subclass 167.11 for liquid purification or separation apparatus comprising a closed circulating system for a swimming pool or spa with means to add a treating material.
- 262 Sulfur extraction:**  
This subclass is indented under subclass 261. Apparatus for the liquid extraction of sulfur from a solid material.
- 263 Including monolithic nonporous body of solute:**  
This subclass is indented under subclass 261. Apparatus having the solid material in the form of a substantially nonporous body of solute, thereby restricting the liquid-solid contact to the outer surface of the body.
- (1) Note. This subclass does not preclude the existence of a flow conducting bore through the solute body to increase the "outer" surface contact area.
- 264 Including means restricting solvent contact to one end of body of solute:**  
This subclass is indented under subclass 261. Apparatus having means restricting the liquid or solvent contact with a body of solute to substantially one end thereof.
- 265 Buoyant holder:**  
This subclass is indented under subclass 261. Apparatus having solute-containing holder constructed to float on a liquid.
- SEE OR SEARCH CLASS:  
210, Liquid Purification or Separation, subclass 167.11 for liquid purification or separation apparatus comprising a closed circulating system for a

- swimming pool or spa with means to add a treating material.
- 266 Manual or mountable holder; e.g., soap holder, etc.:**  
This subclass is indented under subclass 261. Apparatus having a material holder that includes a handle or similar structure, or it is readily connectable to a structure.
- 267 Including means to remove solids from a filter:**  
This subclass is indented under subclass 261. Apparatus having means for removing solids from a filter.
- SEE OR SEARCH CLASS:  
210, Liquid Purification, or Separation, subclass 396 for scraper for cleaning a filter.
- 268 Conveyor support for solid material during contact; e.g., bucket, etc.:**  
This subclass is indented under subclass 261. Apparatus having a support means for conveying the material.
- 269 Including rotating member:**  
This subclass is indented under subclass 261. Apparatus having rotatable means.
- 270 Member is container:**  
This subclass is indented under subclass 269. Apparatus wherein the rotating means is a receptacle.
- SEE OR SEARCH CLASS:  
366, Agitating, subclasses 219+ for agitating by a rotating receptacle.
- 271 Including internal rotating member:**  
This subclass is indented under subclass 270. Apparatus having a rotating means within the container.
- SEE OR SEARCH CLASS:  
366, Agitating, subclasses 244+ for agitating means comprising a receptacle and an internal rotating stirrer.
- 272 Partitions divide container:**  
This subclass is indented under subclass 270. Apparatus where means are provided to separate the container into sections.
- 273 Member conveys material into and out of container; e.g., screw propeller, etc.:**  
This subclass is indented under subclass 269. Apparatus wherein the member transports the solid material through the container.
- 274 Including perforated member which is non-linear or inclined with respect to the major axis of container:**  
This subclass is indented under subclass 261. Apparatus having a perforated member located at an angle other than parallel with the major axis of the container.
- 275 Including parallel perforated members perpendicular to, or parallel to, major axis of container:**  
This subclass is indented under subclass 261. Apparatus having multiple parallel apertured members located perpendicular to, or parallel to, the major axis of the container.
- 276 Side wall of holder perforated:**  
This subclass is indented under subclass 261. Apparatus wherein the side walls of a receptacle are apertured.
- 277 Perforations of holder form inlet for solvent:**  
This subclass is indented under subclass 276. Apparatus where the apertures of the holder form inlet sites of the solvent.
- 278 Including plural orifice inlet, or deflector adjacent inlet for solvent flow:**  
This subclass is indented under subclass 261. Apparatus having a solvent inlet either with plural orifices or with a deflector adjacent to the inlet for directing solvent flow.
- 279 Having inlet submerged within body of a solid solute:**  
This subclass is indented under subclass 278. Apparatus wherein the inlet is submerged within the body of the solid solute.
- 280 Solvent vapor condenser:**  
This subclass is indented under subclass 261. Apparatus having means to condense the solvent vapor.

- 281 Means recirculating solvent:**  
This subclass is indented under subclass 261. Apparatus having means for conveying the solvent from and returning at least a part of it to the contact means.
- 282 Including bypass:**  
This subclass is indented under subclass 261. Apparatus having a separate and distinct path through which a portion or all of the liquid solvent is passed out of contact with the solid being dissolved.
- 283 Including dip tube for inlet or outlet of fluid solvent:**  
This subclass is indented under subclass 261. Apparatus having a tube inserted in a container at a point above the normal level of the liquid contained therein and terminating at a point below the normal liquid level.
- 284 Internal heater; e.g., steam coil, etc.:**  
This subclass is indented under subclass 261. Apparatus having heating means located within the same.
- 285 And heating means:**  
This subclass is indented under subclass 255. Apparatus having means to elevate the temperature of the apparatus or its contents.
- 286 Including mechanical comminuting or conveying means:**  
This subclass is indented under subclass 285. Apparatus having mechanical means to subdivide or transport the material.
- 287 Within treating vessel:**  
This subclass is indented under subclass 286. Apparatus wherein the mechanical means are located inside of the treating container.
- 288 Including means removing vapor from treated material:**  
This subclass is indented under subclass 285. Apparatus having means for taking out gaseous matter from the material being treated.
- 289 And direct contact heating fluid means within separating or dissolving chamber vessel:**  
This subclass is indented under subclass 288. Apparatus having means for directly contacting a heating fluid with the material being treated, the means being located within the chamber in which separation or dissolution occurs.
- 290 And indirect contact heating fluid means in separating or dissolving chamber:**  
This subclass is indented under subclass 288. Apparatus having means for indirectly contacting a heating fluid with the material being treated and being located within the chamber wherein separation or dissolution occurs.
- 291 Combined:**  
This subclass is indented under subclass 243. Apparatus combined with subject matter of other class(es) not specifically provided for in this class.
- 292 Apparatus for treating solid article or material with fluid chemical:**  
This subclass is indented under subclass 243. Apparatus for treating a solid article or material with a "chemical" in a liquid, gaseous, or vapor state wherein the article or material is recovered essentially unchanged from the treatment.
- (1) Note. For purposes of this and indented subclasses, a "chemical" is defined as a substance which has a function beyond that of another class, per se, e.g., drying, heating, cleaning, etc. A recitation that a substance disinfects, sterilizes, deodorizes, or preserves will cause the substance to be considered a "chemical" unless accompanied by positive disclosure that the disinfecting, sterilizing, deodorizing, or preserving is done only by a function provided for elsewhere; e.g., heating, etc.
- (2) Note. Steam is considered a "chemical" also when it disinfects, sterilizes, deodorizes, or preserves, since steam so used appears to have a function more than mere heating. This and indented subclasses contain many patents to steam sterilizers.



SEE OR SEARCH THIS CLASS, SUBCLASS:

39+, for similar processes.

SEE OR SEARCH CLASS:

588, Hazardous or Toxic Waste Destruction or Containment, subclasses 300 through 321 for processes of destruction by any chemical means of hazardous or toxic waste to make such waste safe for landfill disposal, and subclasses 249-260 for processes of permanently storing hazardous or toxic waste per se, particularly subclass 258 for storage of pathogenic organisms (e.g., virus, bacteria, or medical waste).

**293 Fluid having simultaneous diverse function:**  
This subclass is indented under subclass 292. Apparatus wherein the treating fluid performs a simultaneous function other than disinfecting, sterilizing, deodorizing, or preserving; e.g., steam sterilizes and condenses to form distilled water, etc.

**294 Including flexible or collapsible treating chamber:**  
This subclass is indented under subclass 292. Apparatus having a treating chamber made of thin, flexible material; e.g., plastic film.

**295 Including pressure treating chamber (above ambient):**  
This subclass is indented under subclass 292. Apparatus having a compartment for treating the article or material with the compartment pressure being above normal pressure.

SEE OR SEARCH THIS CLASS, SUBCLASS:

28+, for process of disinfecting or sterilizing using steam.

SEE OR SEARCH CLASS:

99, Foods and Beverages: Apparatus, subclasses 323.4+ for cereal puffing apparatus; subclasses 359+ for canned food processors; and subclasses 403+ for food boilers and fryers.

126, Stoves and Furnaces, subclasses 19 through 22 for a cooking stove having an oven, subclasses 273-275 for a

domestic oven, or subclasses 369-369.3 for a liquid heater having a steaming chamber for food.

162, Paper Making and Fiber Liberation, subclasses 233+ for fiber digesters (for making paper pulp).

**296 Fluid pressure maintains closure or seal:**  
This subclass is indented under subclass 295. Apparatus wherein fluid pressure is used to close or seal the apparatus against the positive pressure therein.

**297 And rack, support or handling means:**  
This subclass is indented under subclass 295. Apparatus having a work holder functioning to hold article or material in a desired relation within the compartment or to place the same within, or remove the same from, the compartment.

**298 And vaporizer; e.g., boiler, etc.:**  
This subclass is indented under subclass 295. Apparatus having means to render the fluid gaseous.

**299 Constituting treating chamber:**  
This subclass is indented under subclass 298. Apparatus wherein the vaporizing means is the treating compartment.

**300 Including rack, support or handling means:**  
This subclass is indented under subclass 292. Apparatus having a work holder functioning to hold an article or material in a desired relation within the apparatus or place the same within or remove the same from the apparatus.

SEE OR SEARCH THIS CLASS, SUBCLASS:

297, for the same subject matter enclosed within a pressure chamber.

SEE OR SEARCH CLASS:

211, Supports: Racks, for rack type supports.

248, Supports, for supports of a general nature.

**301 Apparatus closure operates means immersing article or material in liquid chemical:**  
This subclass is indented under subclass 300. Apparatus including a means closing the apparatus and having means operatively connected

therewith for immersing the article or the material in the liquid chemical.

**302 For treating containers or covers therefor:**  
This subclass is indented under subclass 300. Apparatus designed to support or handle containers or covers for containers.

**303 Container is inverted:**  
This subclass is indented under subclass 302. Apparatus wherein the container is supported or handled in an upside-down position.

**304 Including endless conveyer:**  
This subclass is indented under subclass 302. Apparatus wherein the support or handling means is a transporter of the endless type.

**305 Including gas generating means:**  
This subclass is indented under subclass 243. Apparatus having means for creating a gas including generating formaldehyde from a polymer thereof (e.g., paraformaldehyde, etc.).

SEE OR SEARCH THIS CLASS, SUBCLASS:

120+, for apparatus for generating life-sustaining gas.

129+, for apparatus for generating gas using chemical reaction.

SEE OR SEARCH CLASS:

48, Gas: Heating and Illuminating, for apparatus and processes of generating heating or illuminating gas.

99, Foods and Beverages: Apparatus, subclass 276 for generating gas in a beverage by fermentation.

102, Ammunition and Explosives, e.g., subclasses 334, 363, 364+, 367+, and 530+ for gas-generating ammunition and explosives.

122, Liquid Heaters and Vaporizers, for steam generator, per se.

261, Gas and Liquid Contact Apparatus, for apparatus involving carbonation when special arrangements for gas and liquid contact are claimed.

435, Chemistry: Molecular Biology and Microbiology, subclasses 283.1+ for apparatus that includes means for generating gases by fermentation, particularly subclass 300.1 with means for trapping off-gases.

**306 Including means for adding a material to a gas:**

This subclass is indented under subclass 243. Apparatus having means for adding material to the gas.

SEE OR SEARCH THIS CLASS, SUBCLASS:

4, for process of adding material to a gas to treat the same.

28, for process involving the addition of a disinfecting or sterilizing agent to steam.

123, for apparatus for adding a material to a life-sustaining gas.

**307 Heat treating vessel with heating means:**

This subclass is indented under subclass 243. Apparatus comprising container means for treating material at an elevated temperature and means operatively associated with the container for furnishing the elevated temperature.

SEE OR SEARCH CLASS:

99, Foods and Beverages: Apparatus, subclasses 359+ for canned food processors; and subclasses 403+ for food boilers and fryers.

126, Stoves and Furnaces, subclass 343.5 for a melting furnace or subclasses 373.1-390.1 for a liquid heater having an open-top vessel that may include a lid or have its heating means submerged under the liquid.

162, Paper Making and Fiber Liberation, subclasses 253+ for fiber digesters (for making paper pulp) combined with a heater.

165, Heat Exchange, appropriate subclasses for a container with heat-exchange means.

219, Electric Heating, subclass 385 for electric heater combined with a container for material to be heated.

**308 Including multiple stages:**

This subclass is indented under subclass 307. Apparatus wherein multiple heat-treating means are formed by a single vessel being divided or plural vessels interconnected.

- 309 Including comminuting, kneading, or surface-wiping means interior of vessel:**  
This subclass is indented under subclass 307. Apparatus having means within the vessel providing contact and relative movement between two or more apparatus elements for comminuting or kneading the material or wiping the surface of the vessel wall.
- 310 ELEMENTS OR ADJUNCTS:**  
This subclass is indented under the class definition. Apparatus providing for subcombinations not set out above.
- 311 Bed support means (e.g., support grid or plate for supporting particulate bed or contact material, etc.):**  
This subclass is indented under subclass 310. Apparatus comprising a support means for material.
- 312 Tube element containing extended surface contact reaction means (e.g., a tube internally coated or packed with a catalyst, etc.):**  
This subclass is indented under subclass 310. Apparatus comprising a tube element containing solid extended surface contact means.
- 400 Structured visual or optical indicator, per se:**  
This subclass is indented under subclass 50. Apparatus comprising a structured indicator; i.e., an indicator which is more than a composition, per se, and has structure, which gives a visual or optical indication of the presence or amount of material to be tested in the sample.
- (1) Note. Visual or optical indicators, per se, include color indicators such as test papers or test strips and columns which give a visual or optical indication, (e.g., color, etc.) of the presence or amount of material in the sample.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
82.05+, for structured visual or optical indicators which include a standard referencing scale such as pipettes, burettes, color charts, and test strips including a standard colored chart.
- SEE OR SEARCH CLASS:  
116, Signals and Indicators, subclasses 200+ for indicators of general utility.  
252, Compositions, subclass 299.01 for a liquid crystal composition, and 408.1 for a nonreactive analytical, testing or indicating composition.  
436, Chemistry: Analytical and Immunological Testing, appropriate subclasses for analytical and analytical control processes employing liquid crystals.
- 401 In a holder or container:**  
This subclass is indented under subclass 400. Apparatus wherein the indicator is contained in a receptacle (e.g., test plate, dish, tray, slide, etc.).
- 402 Structure to facilitate analysis of the results:**  
This subclass is indented under subclass 401. Apparatus designed to provide easier interpretation of the outcome of the reaction of the indicator with the sample.
- 403 Read by automated means:**  
This subclass is indented under subclass 402. Apparatus wherein the results of the reaction are interpreted using an instrumental analyzer.
- 404 Registration of the structure within the analyzer:**  
This subclass is indented under subclass 403. Apparatus comprising a means for aligning the indicator receptacle inside the instrument prior to measurement.
- 405 Tubular:**  
This subclass is indented under subclass 401. Apparatus wherein the indicator is contained within an elongated cylindrical or oval structure (e.g., test tube, etc.).
- 406 Including a swab:**  
This subclass is indented under subclass 405. Apparatus comprising an absorbent material attached to a grasping member for enabling sample-reagent contact (e.g., swab, etc.).
- 407 Well plate:**  
This subclass is indented under subclass 401. Apparatus wherein the indicator is contained within at least one depression or recessed fea-

ture in a generally planar structure (e.g., microtitre plate, etc.).

SEE OR SEARCH CLASS:

210, Liquid Purification or Separation, appropriate subclasses for multiwell plates having liquid separation membrane structure.

**408 Structure for contacting the sample with the reagent:**

This subclass is indented under subclass 401. Apparatus designed to facilitate the reaction of the indicator with the sample.

**409 Envelope, packet or sleeve (e.g., for fecal occult sample, etc.):**

This subclass is indented under subclass 408. Apparatus wherein the indicator is contained within a flat, thin, folding sheet-like structure.

**410 Lancet (e.g., for finger prick, etc.):**

This subclass is indented under subclass 408. Subject matter comprising a structure for transferring the sample to the indicator reagent structure using a sharp instrument, (e.g., needle, lancet etc.).

SEE OR SEARCH CLASS:

128, Surgery, appropriate subclasses and its dependent classes for a lance or lancet combined with specific structure adapted to interact with the human body.

**411 Swab:**

This subclass is indented under subclass 408. Subject matter comprising a structure for swiping the sample onto an absorbent material containing the indicator reagent structure which is attached to a grasping member, (e.g., a stick or handle etc.).

**412 Device using capillary action:**

This subclass is indented under subclass 408. Subject matter comprising a structure for absorbing the sample onto a receiving material containing the indicator reagent using capillary action.

**413 Device having frangible compartment:**

This subclass is indented under subclass 408. Subject matter comprising a structure for beginning the reactive process by allowing the

contents of separate sample and reagent compartments of a container to mix using a breakable feature of the container.

**414 Device having torturous path:**

This subclass is indented under subclass 408. Subject matter comprising a structure for accomplishing intimate contact between the sample and the reagent by utilizing a porous, reagent containing matrix consisting of serpentine, twisting passages through which the sample components flow.

**415 Including centrifuge:**

This subclass is indented under subclass 408. Subject matter comprising a structure for enabling sample and reagent contact using an apparatus that rotates at high speed around a central axis creating forces that enable transfer of the reagent to the sample or sample to the reagent.

**416 Including means for facilitating reaction of a gaseous fluid:**

This subclass is indented under subclass 408. Subject matter comprising a structure for enabling contact between a sample or reagent in a vapor state so that a reaction occurs.

**417 Including channel, valve or chamber:**

This subclass is indented under subclass 408. Subject matter comprising a compartment, passageway, capillary or flow control feature for enabling sample and reagent contact.

**418 Wiping means to acquire solid test substance:**

This subclass is indented under subclass 408. Subject matter comprising a means for obtaining a solid sample and contacting it with a reagent by a rubbing technique.

**419 Acquisition of liquid sample:**

This subclass is indented under subclass 408. Apparatus comprising a means for obtaining a sample in liquid form and contacting the sample with the reagent.

**420 Having reagent in absorbent or bibulous substrate:**

This subclass is indented under subclass 400. Apparatus wherein a substance used to detect or measure another substance (i.e., indicating reagent) is contained in a substrate capable of

- taking up or sponging liquids via capillary action, (e.g., a dip-stick, test paper, etc.).
- 421 Plural layers:**  
This subclass is indented under subclass 420. Subject matter wherein the absorbent or bibulous substrate has additional strata, (e.g., blocking layer, etc.).
- 422 Filtering:**  
This subclass is indented under subclass 421. Subject matter wherein an additional stratum (e.g., membrane, etc.) is present to treat a sample by removing a certain substance from it while allowing another to pass through to the reagent substrate.
- 423 Spreading:**  
This subclass is indented under subclass 421. Subject matter wherein an additional stratum is present to assist sample diffusion to the reagent substrate.
- 424 Support layer:**  
This subclass is indented under subclass 421. Subject matter wherein an additional stratum (e.g., a polymer, etc.) is present on which other layers are applied.
- 425 Having coated reagent:**  
This subclass is indented under subclass 400. Subject matter wherein the surface of a substrate is covered with a substance, (e.g., indicating reagent, etc.) used to detect or measure another substance.
- 426 Plural layers:**  
This subclass is indented under subclass 425. Subject matter wherein the coated substrate has additional strata, (e.g., blocking layer, etc.).
- 427 Filtering layer:**  
This subclass is indented under subclass 426. Subject matter wherein the substrate contains a stratum, (e.g., membrane, etc.) that is designed to treat a sample by removing a certain substance from it while allowing another to pass through.
- 428 Spreading layer:**  
This subclass is indented under subclass 426. Subject matter wherein an additional stratum is present to assist sample diffusion to the reagent substrate.
- 429 Support layer:**  
This subclass is indented under subclass 426. Subject matter wherein an additional, non-flexible stratum (e.g., glass, etc.) is present on which other layers are applied.
- 430 Test package or kit:**  
This subclass is indented under subclass 50. Apparatus comprising (a) a package containing reagents and all the necessary ingredients to perform a test or (b) self contained test kits for field testing, usually having dosage amounts of each material needed.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
400 through 429, for a structured visual or optical indicator which may be a component of a kit or package.
- SEE OR SEARCH CLASS:  
206, Special Receptacle or Package, subclass 569 for containers for test kits without specified chemical contents such as reagents or reactants.
- 500 Miscellaneous laboratory apparatus and elements, per se:**  
This subclass is indented under subclass 50. Apparatus specifically designed for use in a laboratory.
- 501 Volumetric fluid transfer means (e.g., pipette, pipettor, etc.):**  
This subclass is indented under subclass 500. Apparatus for conveying from one place to another a specified quantity of a liquid or gas.
- 502 Micro-fluidic device:**  
This subclass is indented under subclass 501. Apparatus for precisely controlling and manipulating a liquid or gas which is constrained to a small, typically sub-microliter scale.
- 503 Plate design or structure:**  
This subclass is indented under subclass 502. Apparatus wherein the constraining means is in the form of a flat thin sheet of uniform thickness with micro-channels formed in the surface thereof, and the particular pattern or makeup of that constraining means is recited.

- 504 Liquid moving means:**  
This subclass is indented under subclass 502. Apparatus for causing the liquid or gas to travel within a micro-fluidic device.
- 505 Pump:**  
This subclass is indented under subclass 504. Apparatus wherein a piston, plunger, or a set of rotating vanes is the force which causes fluid to travel within the micro-fluidic device.
- 506 Centrifugal force:**  
This subclass is indented under subclass 504. Apparatus wherein the effect that tends to move an object away from the center of a circle it is rotating about is the force which causes the fluid to travel within the micro-fluidic device.
- 507 Capillary action:**  
This subclass is indented under subclass 504. Apparatus wherein the ability of a narrow interstice to draw a fluid due to surface tension is the force which causes the fluid to travel with the microfluidic device.
- 508 Spray tip:**  
This subclass is indented under subclass 502. Apparatus wherein fluid is delivered to an analyzer in the form of a fine mist.
- 509 Automated system:**  
This subclass is indented under subclass 501. Apparatus wherein the processes of drawing, measurement, delivery, positioning or movement of a liquid are controlled by a machine.
- 510 Including washing means:**  
This subclass is indented under subclass 509. Apparatus additionally including an automated procedure for cleaning the device.
- 511 Including tip attachment or removal:**  
This subclass is indented under subclass 509. Apparatus additionally including an automated procedure for fastening a new fluid delivery end to the device, or taking away a used fluid delivery end.
- 512 Including seal penetration means:**  
This subclass is indented under subclass 501. Apparatus wherein the device tip acts to pierce a container in order to reach a liquid to be drawn into the device.
- 513 Including filter:**  
This subclass is indented under subclass 501. Apparatus wherein a means to trap or to pass a specific liquid or solid in order to separate out constituents is included in the device.
- 514 Mixing of diverse substances within pipette:**  
This subclass is indented under subclass 501. Apparatus wherein an agitation means is included in the device in order to combine plural distinct substances introduced into the device.
- 515 Sequential multidispensing from a single tip:**  
This subclass is indented under subclass 501. Apparatus wherein a single dosing device delivers plural doses before recharging its supply.
- 516 Variable volume:**  
This subclass is indented under subclass 501. Apparatus wherein the device can be set to draw in and expel differing amounts of liquid.
- 517 Including liquid level sensor:**  
This subclass is indented under subclass 516. Apparatus including a device to detect height at which liquid is accumulated within the apparatus.
- 518 Electrically operated:**  
This subclass is indented under subclass 517. Apparatus wherein the means to detect the height of the level of liquid within the device is operated by electricity.
- 519 Interaction of dispensing tip with surface upon which fluid is dispensed:**  
This subclass is indented under subclass 501. Apparatus wherein the end of the device which expels liquid physically contacts the device upon which the liquid is to be deposited.
- 520 Drawing of liquid into pipette by capillary action:**  
This subclass is indented under subclass 501. Apparatus wherein liquid is caused to flow into the device by the ability of a narrow interstice to draw a liquid due to surface tension upwards against the force of gravity.

- 521 Dispensing means:**  
This subclass is indented under subclass 501. Apparatus including a means to expel liquid from the device.
- 522 Pressure:**  
This subclass is indented under subclass 521. Apparatus wherein the means to expel liquid from the device is actuated by a force applied to the top surface of the liquid or a vacuum applied to the bottom of the liquid.
- 523 Gravity:**  
This subclass is indented under subclass 521. Apparatus where the means to expel liquid from the device is the force generated by the mass of the Earth.
- 524 Tip:**  
This subclass is indented under subclass 501. Apparatus dealing with that portion of the device which first receives the liquid, and which last contacts the liquid during expulsion.
- 525 Removable:**  
This subclass is indented under subclass 524. Apparatus wherein the portion of the device which first receives the liquid and last contacts the liquid during expulsion is capable of being taken off the device.
- 526 Including storage rack therefore:**  
This subclass is indented under subclass 525. Apparatus including a structure for storing pipette tips.
- 527 Including means for separating a constituent (e.g., extraction, etc.):**  
This subclass is indented under subclass 500. Apparatus for isolating in a different physical space a particular component of a gas or liquid compound or mixture.
- 528 Evaporator:**  
This subclass is indented under subclass 527. Apparatus including means for changing a liquid to a gas or vapor phase thereby isolating a constituent.
- 529 Operated at ambient temperature:**  
This subclass is indented under subclass 528. Apparatus wherein the transition from liquid to gas or vapor phases occurs at the temperature of its surroundings.
- 530 Heated:**  
This subclass is indented under subclass 528. Apparatus wherein a heat source is used to cause transition from liquid to gas or vapor phase.
- 531 Condenser:**  
This subclass is indented under subclass 527. Apparatus including means to change gas or a vapor to a liquid phase or to separate out combined liquids or liquids and solids in order to separate out specific constituents.
- 532 Cooling means:**  
This subclass is indented under subclass 531. Apparatus wherein the transition from gas or vapor phase to a liquid phase occurs at a temperature below that of its surroundings.
- 533 Gravity or centrifuge separation:**  
This subclass is indented under subclass 527. Apparatus for separation of various combined liquids or liquids from solids wherein separation is carried out by means of the gravitational pull of the Earth or accelerated separation by a device that rotates rapidly and uses centrifugal force to separate substances of different densities.
- 534 Filter:**  
This subclass is indented under subclass 527. Apparatus including means to trap or to pass a specific liquid or solid in order to separate out constituents.
- 535 Porous media:**  
This subclass is indented under subclass 534. Apparatus including a material which permits the movement of certain fluids or gases through it by way of pores or other passages.
- 536 Tissue processing device:**  
This subclass is indented under subclass 500. Apparatus including a device that processes tissue samples in different forms, either thin sections or deposits on a slide or similar carrier,

for purposes such as histological analysis and cytological examination.

- (1) Note. This subclass takes apparatus involved in the analysis of non-viable cells or tissue.

**SEE OR SEARCH CLASS:**

435, Chemistry: Molecular Biology and Microbiology, appropriate subclasses for apparatus involved in the analysis of tissue and cells which are viable/living (e.g., maintained or growing).

**537 Valve:**

This subclass is indented under subclass 500. Apparatus including a device that controls the movement of liquids or gases through pipes or other passages by opening or closing ports and channels.

**SEE OR SEARCH CLASS:**

251, Valves and Valve Actuation, appropriate subclasses for valves and valve actuation in general.

**538 Including connector:**

This subclass is indented under subclass 537. Apparatus which further includes a pipe or other passage which links a valve to another part of the apparatus.

**539 With multiple discrete settings:**

This subclass is indented under subclass 537. Apparatus wherein the valve has several different distinct opening positions.

**540 Stator and rotor, petcock/stopcock, or slider:**

This subclass is indented under subclass 537. Apparatus that comprises a fixed member and a moveable member in contact with the fixed member which rotates about an axis either perpendicular or parallel to the fixed member or moves in parallel to the fixed member.

**541 Check:**

This subclass is indented under subclass 537. Apparatus wherein the valve has an internal structure allowing a unidirectional flow.

**542 Ball or seat:**

This subclass is indented under subclass 537. Apparatus in which a ball with a bore hole passage is mechanically rotated relative to an opening to control flow or in which a seal or seat are mechanically moved relative to one another to control flow.

**543 Gas:**

This subclass is indented under subclass 537. Apparatus wherein the valve is specifically designed for the transfer of material in the gaseous state.

**544 Connector:**

This subclass is indented under subclass 500. Apparatus including a pipe or other passage which links one part of an apparatus to another part.

**545 Terminal end threaded or tapered:**

This subclass is indented under subclass 544. Apparatus wherein an end portion of the connector is provided with a continuous helical ridge or becomes progressively smaller.

**546 For needle, syringe, or capillary tube:**

This subclass is indented under subclass 544. Apparatus wherein the connector is specifically designed for use with a tube having a nozzle and piston for sucking in and ejecting liquid in a thin stream, often fitted with a pointed hollow end for piercing the skin in order to inject or withdraw bodily fluids, or a tube with an internal diameter of hair-like thinness.

**547 Container:**

This subclass is indented under subclass 500. Apparatus including a receptacle for holding material.

**SEE OR SEARCH CLASS:**

206, Special Receptacle or Package, subclasses 363 through 370 for a container for tools employed for body treatment, subclasses 524.1-524.7 for a container of a specified material, and subclass 569 for a container for a test kit without specified chemical contents such as reagents or reactants.



- 548 Used with centrifuge equipment:**  
This subclass is indented under subclass 547. Apparatus consisting of a material holder that is to be used with a machine which turns a material holder round very quickly, causing the solids and liquids inside that material holder to separate by centrifugal action.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
533, for the centrifuge apparatus.
- 549 Tube shaped vessel:**  
This subclass is indented under subclass 547. Apparatus wherein the means for holding material is in the form of an elongated and cylindrical shape (e.g., test tube, etc.).
- 550 Including closure or sealing mechanism:**  
This subclass is indented under subclass 549. Apparatus including a system for covering an opening in the elongated cylindrical member or for keeping out the outside atmosphere.
- 551 Plate, sheet, dish or tray:**  
This subclass is indented under subclass 547. A shallow container having a small depth to length or circumference ratio or a planar, smooth, flat, thin piece of material.
- 552 Including a plurality of wells or receptacles:**  
This subclass is indented under subclass 551. Apparatus wherein the plate or sheet includes distinct multiple test areas, pits, or containers.
- SEE OR SEARCH CLASS:  
210, Liquid Purification or Separation, appropriate subclasses for multiwell plates having liquid separation membrane structure.
- 553 Microtitration plate:**  
This subclass is indented under subclass 552. Apparatus specifically designed for use in a method for determining the concentration of a dissolved substance in terms of the smallest amount of reagent of known concentration required to bring about a given effect in reaction with a known volume of the test solution.
- 554 Cartridge, cassette or cuvette:**  
This subclass is indented under subclass 547. A case or housing having at least one space or slot for accommodating sample or reagent materials.
- 555 Bag type containers:**  
This subclass is indented under subclass 547. Apparatus which includes a flexible or collapsible sack or pouch (e.g., intravenous bags or specimen collection bags, etc.).
- 556 Flask, bottle or beaker:**  
This subclass is indented under subclass 547. A container having a narrow neck opening and wide bottom or a wide opening and cylindrical body.
- SEE OR SEARCH CLASS:  
215, Bottles and Jars, appropriate subclasses for bottles, jars, closures, and attachments therefor.
- 557 Cup or crucible:**  
This subclass is indented under subclass 547. A generally circular container with a narrow base and wide opening.
- 558 Vial or ampoule:**  
This subclass is indented under subclass 547. A cylindrical shaped container that has a removable or frangible closure.
- 559 Including multiple internal compartments or baffles:**  
This subclass is indented under subclass 547. A container having more than one internal chamber.
- 560 Holder:**  
This subclass is indented under subclass 500. Apparatus comprising means to fix in an immobile position an object.
- 561 For sample or specimen container:**  
This subclass is indented under subclass 560. Apparatus comprising means to fix in an immobile position a removable device carrying biological, chemical, or physical items intended for analysis.

- 562 For tube:**  
This subclass is indented under subclass 561. Apparatus comprising means to fix in an immobile position a hollow cylinder closed at one end.
- 563 For slide:**  
This subclass is indented under subclass 561. Apparatus comprising means to fix in an immobile position a small plate used to support an item for analysis.
- 564 For burette, pipette, or pipette tip:**  
This subclass is indented under subclass 561. Apparatus comprising means to fix in an immobile position a hollow, cylindrical liquid volume measuring device or the terminal apparatus thereof.
- 565 Housing:**  
This subclass is indented under subclass 500. Apparatus comprising an enclosure for laboratory equipment or components thereof.
- 566 Support:**  
This subclass is indented under subclass 500. Apparatus comprising means to bear the weight of an object.
- SEE OR SEARCH CLASS:  
211, Supports: Racks, appropriate subclasses for structures designed to support articles.
- 567 Hood:**  
This subclass is indented under subclass 500. Apparatus comprising a cover above laboratory equipment or components thereof.
- 568 Stopper cover, plug, or seal:**  
This subclass is indented under subclass 500. Apparatus including a device that closes the opening of a container.
- 569 Covering multiple containers or wells:**  
This subclass is indented under subclass 568. Apparatus including a closure device for an array of containers or a plurality of well openings.
- 570 Penetrable cover (e.g., septum, etc.):**  
This subclass is indented under subclass 568. Apparatus wherein the closure device is self-sealing when punctured.
- 600 Including plural reaction stages:**  
This subclass is indented under subclass 129. Apparatus comprising multiple reaction means.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
141, for plural fluidized reaction beds.  
156, for plural pigment or carbon making apparatus.  
169, for waste gas purifier having plural stages.
- 601 Including plural parallel reaction stages with each stage in the form of a plate:**  
This subclass is indented under 600. Apparatus wherein the reaction stages in a planar form are arranged side by side in reaction zones and the reactions occur concurrently.
- 602 Plate-type laminated reactor:**  
This subclass is indented under 600. Apparatus wherein the chemical reaction takes place in a device in the form of a plate which is covered by at least one layer of the same or different material.
- 603 Microscale reactor:**  
This subclass is indented under 600. Apparatus wherein the chemical reaction takes place in a micro-structured device, (e.g., micro-reactor, micro-structured reactor, or micro-channel reactor).
- (1) Note. The typical lateral dimension is below 1 mm; the most typical form is micro-channels.
- 604 With gas contact means for degassing or agitating (e.g., sparging, etc.):**  
This subclass is indented under subclass 600. Apparatus for stirring or removing a volatile substance by entrainment from a liquid, or for increasing the liquid/gas contact area using compressed gas entering the liquid through a pipe.

- 605 With draft tube:**  
This subclass is indented under subclass 600. Apparatus comprising a longitudinally extending tubular means open at both ends located within the reaction chamber and providing fluid recirculation within the reaction chamber via fluid movement through the tube.
- 606 With multiphase mixing means:**  
This subclass is indented under subclass 600. Apparatus comprising means to blend substances in different physical states, e.g., a mixing chamber for a liquid and a gas.
- 607 With distributor or collection tray:**  
This subclass is indented under subclass 600. Apparatus comprising means to ensure a steady flow and uniform distribution of fluids, or an apparatus comprising a horizontal shallow container to collect fluids from an upstream reaction stage.
- (1) Note. A distributor can be a distribution plate or tray at the top of the reactor or between superimposed catalyst beds.
- 608 With separation or purification means (e.g., rectification, evaporation, ion exchanger, extraction, settler, absorption, recrystallization, etc.):**  
This subclass is indented under subclass 600. Apparatus including means to segregate components from a mixture or to remove an impurity from a mixture.
- 609 Stripper tower:**  
This subclass is indented under subclass 608. Apparatus wherein at least one stage includes a physical separation process to remove one or more components from a liquid stream through entrainment by a vapor stream.
- 610 Distillation means (e.g., retort, etc.):**  
This subclass is indented under subclass 608. Apparatus including means for separating components of the mixture based on volatility differences, by successive steps of evaporation and subsequent condensation.
- 611 Scrubbing:**  
This subclass is indented under subclass 608. Apparatus including means for separating components of the mixture which uses a scrubbing solution or slurry for removing or neutralizing a specific particle or gas from a gas stream.
- (1) Note. A scrubbing solution can be water or a solution of a reagent for a certain target compound.
- 612 Absorption:**  
This subclass is indented under subclass 608. Apparatus wherein the purification or separation means includes a bibulous material for taking up a component of the mixture.
- 613 Cyclone separator:**  
This subclass is indented under subclass 608. Apparatus wherein the purification or separation means includes a device for removing small or powdered solids from a fluid by centrifugal force.
- 614 Condenser:**  
This subclass is indented under subclass 608. Apparatus wherein the purification or separation includes a cooling means whereby a gas-phase component of the mixture is cooled to turn it into a liquid phase.
- 615 Condenser downstream of a heat exchanging means:**  
This subclass is indented under subclass 614. Apparatus wherein the condenser is positioned following a heat exchanging means.
- 616 Filtering means:**  
This subclass is indented under subclass 608. Apparatus wherein the purification or separation means includes a permeable material, (e.g., a porous material, etc., which traps or passes a specific substance).
- 617 Membrane separation (e.g., palladium membrane hydrogen purifier, etc.):**  
This subclass is indented under subclass 616. Apparatus including means for segregating components of the mixture by a selective barrier impermeable to a group of particles or substances.
- 618 Including product separation or purification means:**  
This subclass is indented under subclass 608. Apparatus including means for segregating a product from a reaction stream, or removing an impurity from a product.

- 619 Combined with contact material regenerating means (e.g., regenerating catalyst, etc.):**  
This subclass is indented under subclass 600. Apparatus wherein a contact material is reproduced or reactivated.
- (1) Note. Contact material has a relatively large contact surface area within a reaction zone wherein a large surface area presents multiple reaction sites for contact by the reaction mixture and, thereby, enhances the rate or the completeness of the reaction.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
620, for recycling reactants.  
631, for plural solid, extended surface, fluid contact reaction stages.  
223, for contact material regenerating means, per se.
- 620 Combined with recycling means (e.g., recycling products, reactants, etc.):**  
This subclass is indented under subclass 600. Apparatus additionally comprising recovering and reusing at least a portion of the product stream or reaction mass in the reaction chamber.
- 621 Including reaction heat recovery or recycling:**  
This subclass is indented under subclass 620. Apparatus wherein the thermal energy from one reaction stage is captured and may be reused.
- 622 Including external recycle loop:**  
This subclass is indented under subclass 620. Apparatus wherein the recycling means includes a conduit located outside of the reaction chamber.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
234, for an external recycle loop, per se.
- 623 Including a boiler:**  
This subclass is indented under subclass 600. Apparatus comprising a vessel in which a fluid is heated to boiling.
- 624 Including a mechanical means for transportation of material (e.g., conveyor, turntable, truck, etc.):**  
This subclass is indented under subclass 600. Apparatus comprising a mechanical apparatus for transporting material (e.g., feedstock, reactant, product, etc.).
- 625 Including reformer reactor:**  
This subclass is indented under subclass 600. Apparatus wherein one of the reaction stages produces hydrogen from hydrocarbons in the presence of a catalyst.
- SEE OR SEARCH CLASS:  
48, Gas: Heating and Illuminating, appropriate subclasses for reforming apparatus specific for the generation of a fuel gas, such as hydrogen, for the purposes of heating or illuminating.  
429, Chemistry: electrical current producing apparatus, product, and process, appropriate subclasses for the combination of a fuel cell and a reactor.
- 626 Including water gas shift reaction:**  
This subclass is indented under subclass 625. Apparatus wherein within the reformer reactor, carbon monoxide reacts with water vapor to produce carbon dioxide and hydrogen.
- 627 Combined with selective or preferential oxidation reactor:**  
This subclass is indented under subclass 625. Apparatus wherein the reformer reactor is combined with a reactor within which a specific reductant gas component is oxidized on a catalyst, e.g., the reactor preferentially oxidizes carbon monoxide using a heterogeneous catalyst.
- 628 Autothermal:**  
This subclass is indented under subclass 625. Apparatus wherein the heat produced by an exothermic reaction is absorbed by an endothermic reaction, e.g., oxygen and carbon dioxide or oxygen and steam react with methane to produce a hydrogen-containing gas mixture.

- 629 Steam reformer:**  
This subclass is indented under subclass 625. Apparatus wherein the reformer reactor uses water vapor in the hydrocarbon reformation to produce hydrogen gas in a product mixture.
- 630 Discrete sequential reaction stages:**  
This subclass is indented under subclass 600. Apparatus having means for subjecting the reaction stream to multiple separate successive reaction stages.
- 631 Plural solid, extended surface, fluid contact reaction stages (e.g., inert Raschig rings, particulate sorbent, particulate or monolithic catalyst, etc.):**  
This subclass is indented under subclass 630. Apparatus including means providing a relatively large solid contact surface area within the reaction zone presents multiple reaction sites for contact by the reaction mixture and, thereby, enhances the rate or the completeness of the reaction.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
177, for this apparatus used in a waste gas purifier.  
211, for this structure, per se.
- 632 With down-flow fixed bed:**  
This subclass is indented under subclass 631. Apparatus comprising an immobilized solid extended surface in contact with a reaction stream moving downward by gravity.
- 633 Including a unitary, monolithic catalyst bed:**  
This subclass is indented under subclass 631. Apparatus wherein the extended surface contact means is a catalyst in the form of a unitary (i.e., non-particulate) contact bed, e.g., a monolithic honeycomb coated with a catalyst, catalyst coated metallic screen, etc.
- 634 With metal catalyst (e.g., metal oxide, etc.):**  
This subclass is indented under subclass 631. Apparatus wherein the extended surface contact means is a catalyst that contains a metal element.
- 635 Including random inert packing (e.g., Raschig rings, balls, saddle rings, etc.):**  
This subclass is indented under subclass 631. Apparatus wherein the extended surface contact means include pieces of chemically inactive material used in large numbers and packed randomly.
- (1) Note. Raschig rings are usually ceramic or metal and provide a large surface area for interaction between liquid and gas or vapor.
- 636 At least one reaction stage formed of a fixed, annularly shaped bed of contact material:**  
This subclass is indented under subclass 631. Apparatus wherein at least one of the extended surface contact means is in the form of a stationary, ring shaped packing.
- 637 With means for directing reaction stream therethrough substantially perpendicular to the longitudinal axis of the bed:**  
This subclass is indented under 636. Subject matter wherein a reactor with at least one of the extended surface contact means in the form of a stationary, ring shaped packing includes means for directing the flow of reactants in a radial direction through the packing.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
181, for this structure in a waste gas purifier.
- 638 Superimposed reaction stages in single reaction chamber:**  
This subclass is indented under subclass 631. Apparatus wherein the reaction stages are located one over the other and within a single reaction chamber.
- 639 Wherein at least one reaction stage is upstream or downstream of parallel stages (e.g., AA-B, etc.):**  
This subclass is indented under subclass 630. Apparatus wherein reaction stages which are arranged side by side in the reaction zone and the reactions occur concurrently are positioned preceding or following a separate reaction stage.

- 640 With parallel repeat of a sequence of reaction stages (e.g., AB-AB, etc.):**  
This subclass is indented under subclass 630. Apparatus wherein at least two sequences of separate successive reaction stages are arranged side by side in the reaction zone.
- 641 With each stage in the form of a reaction tube:**  
This subclass is indented under subclass 630. Apparatus wherein each reaction stage has a relatively high length-to-diameter ratio.
- 642 Wherein the reaction stages are the same:**  
This subclass is indented under subclass 630. Apparatus wherein the reaction stages are repeated, e.g., the same structure, the same catalyst, etc.
- 643 Including thermal combustion means:**  
This subclass is indented under subclass 630. Apparatus wherein one of the discrete sequential reaction stages is thermal oxidative decomposition of a combustible substance.
- 644 Reaction stages located within single reaction chamber:**  
This subclass is indented under subclass 630. Apparatus wherein all the sequential reaction stages are located in a single confining means.
- 645 With baffle (i.e., deflector plate):**  
This subclass is indented under subclass 644. Apparatus comprising a sheet-like structure for directing fluid flow in the single reaction chamber.
- 646 With heating or cooling means:**  
This subclass is indented under subclass 644. Apparatus wherein a heat exchange occurs in the single reaction chamber.
- 647 And means downstream of a stage for internally injecting a reactant into a reaction stream for reaction in a subsequent stage, or injecting an internal quench stream into a reaction stream passing between stages:**  
This subclass is indented under subclass 644. Apparatus having means after a reaction stage for introducing either (a) a reactant into the reaction fluid within the reaction chamber for reaction therewith in a later reaction stage or (b) a quench stream into the reaction fluid within the reaction chamber as the reaction passes between stages.
- 648 Means within reaction chamber for redistributing reaction stream as it passes between adjacent stages:**  
This subclass is indented under subclass 644. Apparatus having means within reaction chamber for redistributing the reaction fluid; i.e., for equalizing or otherwise modifying the velocity profile of the reaction fluid, as it passes between adjacent reaction stages.
- 649 With the provision of heating or cooling means:**  
This subclass is indented under subclass 630. Apparatus comprising means for transferring thermal energy in any of the sequential reaction stages.
- 650 Including plural parallel reaction stages with each stage in the form of a reaction tube:**  
This subclass is indented under subclass 600. Apparatus wherein the reaction stages are arranged side by side in reaction zones with relatively high length-to-diameter ratios and the reactions occur concurrently.
- 651 Tubular stages in a single reaction chamber:**  
This subclass is indented under subclass 650. Apparatus wherein the reaction tubes are located within a single reaction confining area, e.g., a tube and shell reactor with the reactant flowing through the tubes.
- 652 Reaction tubes filled with catalyst particles:**  
This subclass is indented under subclass 651. Apparatus wherein the reaction tube contains a catalyst in a particulate form.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
172, for waste gas purifier having plural chemical stages and means downstream of a stage for injecting a reactant into the gas for interaction in a subsequent stage.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
222, for parallel passages through a monolithic mass; e.g., honeycomb catalyst, etc.

- 653 Reaction tubes containing structured catalyst:**  
This subclass is indented under subclass 651. Apparatus wherein the catalyst in the reaction tube has a specific solid shape.
- 654 Reaction tubes having catalyst coating:**  
This subclass is indented under subclass 651. Apparatus wherein the tubular surface is covered with a layer or film of catalyst.
- 655 Individual supply of reactants for each reaction tube:**  
This subclass is indented under subclass 651. Apparatus wherein the starting materials are fed separately to each tube.
- 656 With a solid reactant:**  
This subclass is indented under subclass 651. Apparatus wherein the starting material is of stable shape and volume.
- 657 Operating at positive pressure:**  
This subclass is indented under subclass 651. Apparatus wherein the reaction stage is functioning above ambient pressure.
- 658 With tube plate (e.g., supporting plate):**  
This subclass is indented under subclass 651. Apparatus wherein the tubes are fixed on a planar structure.
- 659 With heating or cooling means:**  
This subclass is indented under subclass 651. Apparatus wherein the single reaction chamber includes a means for thermal energy transfer.
- 902 SODIUM CHLORIDE AND POTASSIUM CHLORIDE DISSOLVER:**  
A cross-reference art collection of apparatus specifically designed for the dissolution of NaCl or KCl.
- 903 RADIOACTIVE MATERIAL APPARATUS:**  
Apparatus for making or containing radioactive material.
- 904 NITROGEN FIXATION MEANS:**  
Art collection relevant to subclasses 186+ comprising documents disclosing the separation of nitrogen as nitrogen compounds from the other components of air.
- 905 MISCELLANEOUS LIQUID STERILIZATION MEANS:**  
Art collection relevant to subclasses 186+ comprising documents disclosing means for sterilization of miscellaneous liquids employing electromagnetic wave energy or corpuscular radiation.
- 906 PLASMA OR ION GENERATION MEANS:**  
Art collection relevant to subclasses 186+ comprising documents disclosing means for generating ions or plasma.
- 907 CORONA OR GLOW DISCHARGE MEANS:**  
Art collection relevant to subclasses 186+ comprising documents disclosing apparatus comprising means to produce a corona discharge or a glow discharge.

## CROSS-REFERENCE ART COLLECTIONS

- 900 DECREASING POLLUTION OR ENVIRONMENTAL IMPACT:**  
A cross-reference art collection under subclasses 1 through 43 comprising process of diminishing unclean conditions or detrimental conditions affecting the environment.
- 901 POLYMER DISSOLVER:**  
A cross-reference art collection of apparatus specifically designed for the dissolution of a polymer.

## FOREIGN ART COLLECTIONS

The definitions below correspond to abolished subclasses from which these collections were formed. See the Foreign Art Collection schedule of this class for specific correspondences. [Note: The titles and definitions for indented art collections include all the details of the one(s) that are hierarchically superior.]

- FOR 100 Structured visual or optical indicator, per se (422/55):**  
This foreign art collection is indented under unnumbered placeholder 422/50. Foreign art collection comprising (a) a structured indicator; i.e., an indicator which is more than a

composition, per se, and has structure, or (b) liquid crystals, per se, which give a visual or optical indication of the presence or amount of material to be tested in the sample.

- (1) Note. A visual or optical indicators, per se, include color indicators such as test papers or test strips and columns which give a visual or optical indication (e.g., color) of the presence or amount of material in the sample.

**FOR 101 Having reagent in absorbent or bibulous substrate(422/56):**

This foreign art collection is indented under FOR 100. Foreign art collection for apparatus wherein indicating reagent is contained in absorbent or bibulous carrier or substrate; e.g., a dip-stick, test paper, wick, etc.

**FOR 102 Having coated reagent(422/57):**

This foreign art collection is indented under FOR 100. Foreign art collection for apparatus wherein the reagent is coated on the surface of a carrier or substrate.

**FOR 103 In holder or container having special form(422/58):**

This foreign art collection is indented under FOR 100. Foreign art collection for apparatus wherein the indicator is contained in a holder or container having a special form or design; e.g., test plates, dish, tray, slide, etc.

**FOR 104 Column(422/59):**

This foreign art collection is indented under FOR 103. Foreign art collection for apparatus in the form of a column-like structure.

**FOR 105 Having plural-layered material(422/60):**

This foreign art collection is indented under FOR 104. Foreign art collection for apparatus having material consisting of multiple distinct layers.

**FOR 106 Test package or kit(422/61):**

This foreign art collection is indented under unnumbered placeholder 422/50. Foreign art collection wherein the apparatus comprising (a) a package containing reagents and all necessary ingredients to perform a test or (b) self-contained test kits for field testing, usually having dosage amounts of each material needed.

**FOR 107 Miscellaneous laboratory apparatus and elements, per se(422/99):**

This foreign art collection is indented under unnumbered placeholder 422/50. Foreign art collection for apparatus specifically designed for use in a laboratory.

**FOR 108 Pipette or other volumetric fluid transfer means(422/100):**

This foreign art collection is indented under FOR 107. Foreign art collection for apparatus having means for volumetrically transferring a fluid.

**FOR 109 Including means for separating a constituent; e.g., filter, condenser, extractor, etc.(422/101):**

This foreign art collection is indented under FOR 107. Foreign art collection for apparatus having means for separating a constituent by filtration, condensation, extraction, etc.

**FOR 110 Container(422/102):**

This foreign art collection is indented under FOR 107. Foreign art collection for apparatus having means for holding material.

**FOR 111 Valve or connector structure(422/103):**

This foreign art collection is indented under FOR 107. Foreign art collection for apparatus having valve or connector structure or this structure, per se.

**FOR 112 Holder, support, housing, or hood(422/104):**

This foreign art collection is indented under FOR 107. Foreign art collection for apparatus for supporting, maintaining in a desired relationship with other structure, or surrounding other laboratory structures.

**FOR 113 Including plural reaction stages(422/188):**

This foreign art collection is indented under unnumbered placeholder 422/129. Foreign art collection for apparatus comprising multiple reaction means.

**FOR 114 And means providing discrete sequential reaction stages, e.g., train, etc.(422/189):**

This foreign art collection is indented under FOR 113. Foreign art collections for apparatus having means for subjecting the reaction



stream to multiple separate successive reaction stages.

**FOR 115 Plural solid, extended surface, fluid contact reaction stages each containing; e.g., inert raschig rings, particulate sorbent, particulate or monolithic catalyst, etc.(422/190):**

This foreign art collection is indented under FOR 114. Foreign art collection for apparatus including solid extended surface fluid contact reaction means, i.e., means providing a relatively large solid contact surface area within the reaction zone wherein large surface area within the reaction zone wherein large surface area presents multiple reaction sites for contact by the reaction mixture and, thereby, enhance the rate and/or the completeness of the reaction, including; e.g., inert raschig rings, particulate absorbent, etc.

**FOR 116 Superimposed reaction stages in single reaction chamber(422/191):**

This foreign art collection is indented under FOR 115. Foreign art collection for apparatus wherein the reaction stages are located one over the other and within a single reaction chamber.

**FOR 117 At least one reaction stage formed of fixed, annularly shaped bed of contact material and means directing reaction stream therethrough substantially perpendicular to longitudinal axis of bed(422/192):**

This foreign art collection is indented under FOR 115. Foreign art collection for apparatus wherein at least one of the extended surface contact means is in the form of a relatively fixed, annularly shaped bed of contact material and including means for directing the flow of reactants through the contact bed in a direction substantially perpendicular to the longitudinal axis of the contact bed.

**FOR 118 Reaction stages located within single reaction chamber(422/193):**

This foreign art collection is indented under FOR 114. Foreign art collection for apparatus wherein the reaction stages are located in a single confining means.

**FOR 119 And means downstream of a stage for internally injecting a reactant into a reaction stream for interreaction in a subsequent stage, or injecting an internal quench stream into reaction stream passing between stages(422/194):**

This foreign art collection is indented under FOR 118. Foreign art collection for apparatus having means after a reaction stage for injecting either (a) a reactant into the reaction stream within the reaction chamber for reaction therewith in a subsequent reaction stage or (b) a quench stream into the reaction stream within the reaction chamber as the reaction passes between stages.

**FOR 120 Means within reaction chamber redistributing reaction stream as it passes between adjacent stages(422/195):**

This foreign art collection is indented under FOR 118. Foreign art collection for apparatus having means within reaction chamber for redistributing the reaction stream; i.e., for equalizing or otherwise modifying the velocity profile of the reaction stream, as it passes between adjacent reaction stages.

**FOR 121 Including plural parallel reaction stages with each stage in form of a reaction tube(422/196):**

This foreign art collection is indented under FOR 113. Foreign art collection for apparatus wherein the reaction stages are formed by parallel (i.e., nonsequential) reaction tubes; i.e., reaction zones with relatively high length-to-diameter ratios.

**FOR 122 Tubular stages in single reaction chamber(422/197):**

This foreign art collection is indented under FOR 121. Foreign art collection for apparatus wherein the tubes are located within a single reaction confining area; e.g., a tube and shell reactor with the reactant flowing through the tubes.

END