CLASS 203, DISTILLATION: PROCESSES, SEPARATORY

SECTION I - CLASS DEFINITION

GENERAL STATEMENT OF CLASS SUBJECT MATTER

This is the residual class for processes for separating a liquid mixture (distilland) by vaporizing and condensing at least a portion thereof to isolate in the condensed liquid (distillate) or in the unvaporized portion (residue) a comparatively pure compound which was present as such in the original mixture. The original mixture may be a solid under normal atmospheric conditions if it liquifies below the vaporization temperature.

To come within the purview of this class (203) the distilland must have a boiling point above 0°C. under normal atmospheric pressure. Because the C4 hydrocarbons have boiling points above and below 0°C., all C4 hydrocarbons are arbitrarily classified as having boiling points above 0°C.

Sublimination (see Glossary) is excluded from this class (203). See References to Other Classes, below.

When claims are presented which recite a specific chemical compound or mixture to be recovered, the enumerated classifications set forth in Lines With Other Classes must be consulted to see if such subject matter is provided for in other than Class 203.

SECTION II - LINES WITH OTHER CLASSES AND WITHIN THIS CLASS

LINES WITH CHEMICAL COMPOSITION CLASSES

(1) Products whether claimed in terms of their composition or claimed in terms of the process of making are classified in the appropriate composition class even if the process merely recites a separatory distillation operation.

(2) Processes including a chemical reaction and a separatory distillation operation are classified here only when the chemical reaction merely facilitates the isolation by the separatory distillation operation of a preexisting substance in the distilland. See Class 260, Chemistry of Carbon Compounds, Class 423, Chemistry of Inorganic Compounds, or Class 585, Chemistry of Hydrocarbon Compounds for a process of preparing a compound and isolating it by a separatory distillation process.

(3) Processes including a separatory distillation step and a disparate physical separation step, such as extraction, are classified in this class (203) if the disparate separating step follows the distillation step and the process is not otherwise provided for. When the disparate separation step precedes the distillation step, the process is generally provided for elsewhere.

See Class 260, Chemistry of Carbon Compounds (including Class 585, Chemistry of Hydrocarbon Compounds) or Class 423, Chemistry of Inorganic Compounds, for a process of extraction of a compound, either as a sole step or followed by isolating the compound by a separatory distillation process.

(4) Processes directed solely to a separatory distillation operation are classified in this class (203) unless otherwise provided for:

(a) Processes for the distillation of metals, such as mercury or zinc are classified in Class 75, Specialized Metallurgical Processes, Compositions for Use Therein, Consolidated Metal Powder Compositions, and Loose Metal Particulate Mixtures.

(b) Processes for distilling a mineral oil in which the product isolated is a pure compound are classified in this class (203). However, when the distillation process produces as the product a mineral oil, it is classified in Class 208, Mineral Oils: Processes and Products.

(c) Processes which include fermentation are classified in 435, Chemistry: Molecular Biology and Microbiology, even if such processes also include distillation.

(d) Processes for distilling fermented beverage to produce a distilled beverage are classified in Class 426, Food or Edible Material: Processes, Compositions, and Products, but processes for distilling a fermented beverage to isolate alcohol are classified here (203).

(e) When a patent contains a Class 423, Chemistry of Inorganic Compounds, process claim and a Class 203, Distillation: Processes, Separatory, process claim, the patent is classified in Class 423 and cross-referenced to Class 203.

PROCESSES INCLUDING EVAPORATION

Processes for evaporating without a condensing step are generally excluded from this class. For specific lines

between the processes of this class and other processes including an evaporating step, see below.

This class (203) is distinguished from Class 34, Drying and Gas or Vapor Contact With Solids, in that the material treated herein (203) is a liquid or a liquefiable solid from which volatile material is to be separated and condensed or absorbed. The product recovered must be a relatively pure substance which existed as such in the original material. The material of Class 34 is a solid or semi-solid from which it is desired to remove a liquid, leaving the residue chemically unchanged.

Class 134, Cleaning and Liquid Contact With Solids, takes claimed combinations of work handling or supporting means or steps with means or steps to apply a liquid to the work, as by spraying or immersion, where said liquid is distilled or evaporated, whether or not the resulting vapor is (1) directly contacted with the work or (2) condensed for reuse to contact the work. When only the liquid distillation subcombination or the vapor-phase work contact subcombination has been claimed, see above for the line between Class 203 and Class 34.

Class 62, Refrigeration, includes processes for separating a mixture of substances having boiling points below 0°C. (32°F) at atmospheric pressure by the steps of vaporizing a component and condensing the vapor. When a patent includes species claims classifiable in Class 62 and Class 203, it is classified in Class 62 and cross-referenced to Class 203.

Class 95, Gas Separation: Processes, takes processes in which gas is removed from a liquid wherein the gas is normally gaseous at a temperature of 0°C and a pressure of 760 mm Hg (e.g., hydrogen sulfide (H_2S), carbon monoxide (CO), carbon dioxide (CO_2), etc.). The volatile need not be condensed. The line between Class 95 and Class 203 is that a Class 203 operation requires vaporizing and condensing a material which is normally a liquid, while Class 95 does not.

Class 159, Concentrating Evaporators, takes processes for concentrating solids in solution or suspension by volatilizing the liquid. It is distinguished from this class (203) by the fact that the volatile material is not condensed.

Some additional classes which provide for processes that include an evaporating step or a concentrating step are: Class 23, Chemistry: Physical Processes; Class 127, Sugar, Starch, and Carbohydrates; Class 260, Chemistry, Carbon Compounds; Class 426, Food or Edible Material: Processes, Compositions, and Products; Class 520, Synthetic Resins or Natural Rubbers; Class 585, Chemistry of Hydrocarbon Compounds; Class 588, Hazardous or Toxic Waste Destruction or Containment.

CLASS 201, DISTILLATION: PROCESSES, THERMOLYTIC, IS SUPERIOR TO CLASS 203.

SECTION III - REFERENCES TO OTHER CLASSES

SEE OR SEARCH CLASS:

23, Chemistry: Physical Processes, subclass 294 For general sublimation processes see and Class.

62, Refrigeration, appropriate subclasses for processes and apparatus peculiar to removing heat from a substance.

75, Specialized Metallurgical Processes, Compositions for Use Therein, Consolidated Metal Powder Compositions, and Loose Metal Particulate Mixtures, appropriate subclasses for a process of reducing an ore to the metallic state or refining molten metal involving distillation or for a sublimination process.

75, Specialized Metallurgical Processes, Compositions for Use Therein, Consolidated Metal Powder Compositions, and Loose Metal Particulate Mixtures, for the sublimation of metals.

95, Gas Separation: Processes, for processes involving steps resulting in separation of a gas from a fluid mixture comprising (a) a gas and solid or liquid particles entrained therein, (b) a liquid and gas entrained therein, or (c) a plurality of gases.

99, Foods and Beverages: Apparatus, subclasses 275+ for apparatus for preparing beverages.

106, Compositions: Coating and Plastic, appropriate subclasses for a coating composition which may be applied to surfaces of the distillation apparatus or utilized for making apparatus of a particular composition.

122, Liquid Heaters and Vaporizers, appropriate subclass for heating liquids, superheating or cooling the vapors generated and conserving the heat in the liquid or vapor in a closed system.

134, Cleaning and Liquid Contact With Solids, subclasses 1+ for a cleaning process, particularly subclass 12 for a process including the step of distilling the treating agent and subclass 31 for a process including the step of condensing a gas or vapor.

159, Concentrating Evaporators, for apparatus and processes not more specifically provided for elsewhere, peculiar to the concentration of solids held in solution or suspension by evaporation of the liquid containing them. See subclasses 48.1+ for a process of concentrating by spraying and subclass 49 for a process of concentrating by a filming operation. See also subclasses 5+ for a film type evaporator.

210, Liquid Purification or Separation, appropriate subclasses for a process for purifying or separating a liquid by (1) sorption or ionic exchange, (2) filtration, (3) liquid-liquid extraction, (4) purification by destruction or conversion of a constituent thereof.

261, Gas and Liquid Contact Apparatus, appropriate subclasses for apparatus adapted to produce an intimate contact between gases and liquids and see (2) Note under the class definition.

366, Agitating, subclasses 219+ for apparatus for agitating a liquid or a particulate material by motion of the container, and subclasses 241+ for a fixed container with movable stirring apparatus, particularly subclasses 262+ for pump type stirrers.

426, Food or Edible Material: Processes, Compositions, and Products, subclasses 11+ for processes of preparing alcoholic beverages including distillation.

532, Organic Compounds, appropriate subclasses for general sublimation processes.

585, Chemistry of Hydrocarbon Compounds, subclass 801 for general sublimation processes.

588, Hazardous or Toxic Waste Destruction or Containment, subclasses 300 through 320 for distillation process in the chemical destruction of hazardous or toxic waste.

SECTION IV - GLOSSARY

AZEOTROPIC DISTILLATION

A separatory distillation of a liquid in which a substance is added to the distilland mixture in order to assist separation of its components by forming with one or more of the components a mixture having a minimum boiling point. (The art has also used the term for a distillation process in which two substances in the starting material are removed by their forming a minimum boiling mixture).

CONDENSATE

See “distillate” in the class definition.

CONVECTIVE DISTILLATION

A separatory distillation operation in which an inert vapor is passed through a heated liquid to reduce the partial vapor pressure of the component in the liquid desired to be recovered. It permits the separation of heat sensitive high boiling substances at temperatures below their decomposition temperature. Steam distillation is the most commonly used type of convective distillation.

DISTILLAND

For purposes of this class the liquid or liquefied material which is undergoing a distillation operation.

DISTILLATE

The liquid product condensed from vapor during the distillation operation.

EVAPORATION

The process of changing a solid or liquid into a vapor. This is the generic term for both sublumination and vaporization. It differs from “distillation” in that distillation includes the additional step of condensing vapor produced to a liquid.

EXTRACTIVE DISTILLATION

A separatory distillation in which a generally less volatile substance, often referred to as a solvent, is added to the distillation column to preferentially remove some component of the vapor by dissolving it. The added substance and the dissolved component are removed below the point at which the less volatile substance is added to the distillation column.

FLASH VAPORIZATION

The process in which the distilland is heated under pressure high enough to prevent ebullition (usually above atmospheric pressure) and the heated distilland is then introduced into a zone of lesser pressure resulting in the volatilization of at least a position of the distilland.

FRACTIONAL DISTILLATION

A separatory distillation operation in which distillate is collected over specific temperature intervals.

MOLECULAR DISTILLATION

A high vacuum separatory distillation process for distilling high boiling, heat sensitive substances in which the distance from the liquid surface to the condensing surface is less than the mean free path.

SEPARATORY DISTILLATION

A process of vaporizing at least a portion of a liquid mixture (distilland) and condensing at least a portion of the vapor to separate the liquid mixture into distinct parts. The substances recovered as products must have preexisted in the original mixture.

STEAM DISTILLATION

A form of convective distillation in which the inert vapor passed through the heated liquid is steam. The adding of water or steam to a distillation column or the adding of water to a distilland is not within the meaning of this term.

SUBLIMATION

A process in which a solid passes into the vapor state without liquefaction and the vapor returns to the solid state without passing through the liquid phase.

THERMOLYTIC DISTILLATION

A distillation in which material found in the distilland undergoes chemical decomposition (thermolysis) to form different substances at least some of which are volatile at the temperature employed. The volatile substances are recovered by condensation or sorption.

VAPORIZATION

The process of changing a liquid into a vapor. See "Evaporation".

SUBCLASSES

1 WITH MEASURING, TESTING OR INSPECTING:

This subclass is indented under the class definition. Processes combined with the positive step of visually, chemically or physically determining some chemical or physical characteristic or property of the feed, vapor, residue or condensate.

(1) Note. The chemical or physical characteristic must be positively stated in the claim for the purpose of this and indented subclasses, e.g., measuring the temperature. Heating to a specified temperature is not determining a characteristic within the purview of this and indented subclasses.

SEE OR SEARCH CLASS:

73, Measuring and Testing, appropriate subclasses for measuring and testing apparatus.

137, Fluid Handling, subclasses 2+ for a process in which a condition or characteristic of a fluent material is determined and used to control the system.

162, Paper Making and Fiber Liberation, subclass 238 for a digester with automatic control means.

196, Mineral Oils: Apparatus, subclass 132 for mineral oil vaporizing apparatus provided with automatic control.

201, Distillation: Processes, Thermolytic, subclass 1 for a process directed to thermolytic distillation combined with measuring, testing or inspecting.

202, Distillation: Apparatus, subclasses 151, 160, 193, 196, 206 for distillation apparatus having control devices and see "SEARCH CLASS" under each subclass.

361, Electricity: Electrical Systems and Devices, appropriate subclasses for electrical systems not otherwise classified and see "SEARCH CLASS" under the class definitions for various types of electrical systems.

436, Chemistry: Analytical and Immunological Testing, subclasses 230+ for a process of chemically testing not combined with a distillation process.

2 Of temperature or pressure:

This subclass is indented under subclass 1. Processes directed to specifically determining the temperature and/or pressure of the feed, vapor, residue or condensate.

SEE OR SEARCH CLASS:

73, Measuring and Testing, appropriate subclasses for device for quantitatively measuring temperature and

700+ for a device for the direct measurement of pressure.

137, Fluid Handling, subclasses 2+ for a process of fluid handling in which one or more characteristics or conditions of a fluent material are determined, particularly subclass 14 for a process involving pressure control.

202, Distillation: Apparatus, subclass 160 for a separatory distillation system including a column provided with automatic temperature and/or pressure control, and see "SEARCH THIS CLASS, SUBCLASS" and "SEARCH CLASS" thereunder for related fields of search.

374, Thermal Measuring and Testing, subclasses 100+ for a device for quantitatively determining temperature.

532, Organic Compounds, appropriate subclasses for a process directed to temperature control.

585, Chemistry of Hydrocarbon Compounds, subclass 956 for a collection of patents concerned with condition-responsive control procedures in hydrocarbon purification processes.

3 Of concentration:

This subclass is indented under subclass 1. Processes including the steps of determining the concentration of the feed, vapor, residue or condensate.

SEE OR SEARCH CLASS:

73, Measuring and Testing, subclasses 32+ for apparatus for determining density and/or specific gravity of a liquid.

137, Fluid Handling, subclasses 2+ for a process of fluid handling in which one or more characteristics or conditions of a fluent material are determined.

356, Optics: Measuring and Testing, subclass 450 for interferometers and subclasses 128+ for refractometers.

4 INCLUDING PURGING OF THE SYSTEM:

This subclass is indented under the class definition. Processes combined with a step of removing a contaminant from the separatory apparatus.

(1) Note. Usually a material, such as a gas, is passed through the apparatus to remove the contaminant.

SEE OR SEARCH CLASS:

95, Gas Separation: Processes, subclasses 241+ for degasification of liquid.

134, Cleaning and Liquid Contact With Solids, subclasses 1+ for a process of separating or removing adherent undesired matter from solid material and subclasses 43+ for apparatus for cleaning by liquid contact.

137, Fluid Handling, subclasses 15.01 through 15.26 for a process of cleaning, repairing or assembling.

201, Distillation: Processes, Thermolytic, subclass 2 for a process of cleaning the apparatus or removing adhering char product.

5 SEPARATING ISOTOPES OR TAUTOMERS:

This subclass is indented under the class definition. Processes directed to separating (1) the atoms of a given element or a compound containing said atoms according to the atomic weights of said atoms according to the atomic weights of said atoms or (2) a mixture containing at least two tautomeric forms of a substance initially in a state of equilibrium.

(1) Note. A mixture of H2O and D2O is an example of a feed mixture containing hydrogen atoms of different atomic weights.

(2) Note. Separating by distillation the ketoenol forms of a compound is within the purview of this subclass.

SEE OR SEARCH CLASS:

95, Gas Separation: Processes, subclasses 31+ for processes in which a plurality of gases is separated by making use of physical difference in weight.

423, Chemistry of Inorganic Compounds, subclass 580.1 for processes of producing water and subclass 580.2 for processes of producing heavy water including a chemical reaction.

6 **ADDITION OF MATERIAL TO DISTILLAND TO INHIBIT OR PREVENT REACTION OR TO STABILIZE:**
This subclass is indented under the class definition. Processes including adding an element or a chemical compound or mixture (of substances) to the distilland or the vapor to inhibit or prevent formation of scale on the apparatus and/or to inhibit or prevent corrosion of the apparatus and/or to inhibit or prevent an unwanted reaction of the feed, vapor, residue or condensate.

(1) Note. The addition of a scale inhibiting material to water being distilled or the addition of a corrosion inhibiting material to an acidic material being distilled or the addition of a material which inhibits the polymerization of an olefin at the temperature of the distillation are nonlimiting examples of the scope of this and indented subclasses.

SEE OR SEARCH THIS CLASS, SUBCLASS:
86, for a separatory distillation process including the use of a surface of a specific composition which thereby inhibits or prevents an unwanted reaction.

SEE OR SEARCH CLASS:
252, Compositions, subclasses 397+ for compositions for preventing, inhibiting or reducing oxidation, chemical decomposition, or other chemical change.
260, Chemistry of Carbon Compounds, and its daughter Classes 530-570 for a nonhydrocarbon organic compound containing a stabilizer.
422, Chemical Apparatus and Process Disinfecting, Deodorizing, Preserving, or Sterilizing, subclasses 7+ for process of maintaining an environment nondestructive to metal.
585, Chemistry of Hydrocarbon Compounds, subclasses 1+ for a hydrocarbon compound containing a stabilizer.

7 **For scale inhibiting or corrosion preventing:**
This subclass is indented under subclass 6. Processes directed to adding a substance to inhibit or prevent corrosion of the apparatus and/or to inhibit or prevent scale formation.

SEE OR SEARCH CLASS:
196, Mineral Oils: Apparatus, subclass 133 for a mineral oil vaporizer having some special feature of construction.
202, Distillation: Apparatus, subclass 267.1 for apparatus in terms of the materials of construction.
208, Mineral Oils: Processes and Products, subclass 47 for a process of treating mineral oil including a step to prevent or reduce corrosion or erosion of the apparatus employed in the process and see "SEARCH THIS CLASS, SUBCLASS" and "SEARCH CLASS" thereunder for related fields of search.
252, Compositions, subclasses 175+ for water-softening or purifying or scale-inhibiting agents, and subclasses 387+ for anti-corrosion agents.

8 **For inhibiting or preventing a polymerization reaction:**
This subclass is indented under subclass 6. Processes directed to adding a substance to inhibit or prevent unwanted polymerization.

SEE OR SEARCH THIS CLASS, SUBCLASS:
30, for a separatory distillation process in which a substance is added to cause a desired polymerization of at least one component.

9 **Of unsaturated hydrocarbon:**
This subclass is indented under subclass 8. Processes directed to inhibiting or preventing the polymerization of an unsaturated hydrocarbon.

10 **WATER PURIFICATION ONLY:**
This subclass is indented under the class definition. Processes of purifying water in which the only material recovered as a product is water.

SEE OR SEARCH CLASS:

159, Concentrating Evaporators, subclasses 5+ for concentrating apparatus of the film type, subclasses 13.1+ for evaporating apparatus designed to maintain the liquid being evaporated in a film, and subclass 49 for an evaporating process in which the liquid to be concentrated is spread in a thin film.

165, Heat Exchange, appropriate subclasses for a process of adding water vapor to air or removing water vapor from air.

202, Distillation: Apparatus, subclass 167 for a separatory distillation apparatus which includes a still and a feed water heater.

210, Liquid Purification or Separation, subclasses 600+ for a process of purifying a liquid not otherwise provided for.

423, Chemistry of Inorganic Compounds, subclass 580.1 for processes of producing water and 580.2 for processes of producing heavy water including a chemical reaction.

11 Under pressure or vacuum:

This subclass is indented under subclass 10. Processes in which distillation is carried out under a pressure greater than atmospheric or under a vacuum.

SEE OR SEARCH THIS CLASS, SUBCLASS:

73+, for a plural distillation process in which at least one distillation is under pressure or vacuum.

91+, for a single distillation process carried out under pressure or vacuum.

12 DISTILLING TO SEPARATE OR REMOVE ONLY WATER:

This subclass is indented under the class definition. Processes in which only water is removed from the feed mixture.

(1) Note. For purposes of this and indented subclasses water is the impurity of the distilland which is to be removed. A process of removing other impurities as well as water is excluded.

(2) Note. A plural distillation process of separating only water by adding an extraneous liquid to the distilland to alter the relative volatility of water and the liquid be dried in the initial distillation step and then distilling a product of the initial distilling operation to separate the extraneous liquid is classified here.

SEE OR SEARCH THIS CLASS, SUBCLASS:

10+, for a process in which the only material recovered as a product is water.

50+, for a process directed to adding a specific extraneous material to alter the relative volatility of a component of a mixture.

SEE OR SEARCH CLASS:

23, Chemistry: Physical Processes, subclass 306 for a process of concentrating a solution of a liquid in a liquid not otherwise provided for.

34, Drying and Gas or Vapor Contact With Solids, appropriate subclasses, under “Processes” for a process for separating a liquid from a solid.

62, Refrigeration, subclasses 93+ for a process of removing moisture from air.

95, Gas Separation: Processes, appropriate subclasses for processes of removing water from a gaseous fluid mixture. See particularly subclasses 117+ for solid sorption processes to remove water from a gaseous fluid mixture and subclass 231 for processes of liquid contacting to remove water from a gaseous fluid mixture.

13 From nitric acid:

This subclass is indented under subclass 12. Processes in which the liquid substance is aqueous nitric acid.

SEE OR SEARCH CLASS:

423, Chemistry of Inorganic Compounds, subclasses 390.1+ for producing nitric acid by a chemical reaction.

14 From organic compound:
This subclass is indented under subclass 12. Processes for separating water from an organic compound.

(1) Note. Mixtures of organic substances from which only water is separated by a distillation step are included in this and indented subclasses unless otherwise provided for.

SEE OR SEARCH CLASS:
208, Mineral Oils: Processes and Products, subclasses 187+ for a process for removing water from mineral oils and see "Note", "SEARCH THIS CLASS, SUBCLASS" and "SEARCH CLASS" in subclass 187 for related processes for removing water from organic mixtures.
260, Chemistry of Carbon Compounds, appropriate subclasses for a process including removing water by distillation combined with a step for forming a compound or extracting the compound from a natural source.

15 Organic acid:
This subclass is indented under subclass 14. Processes in which the organic substance is an organic acid.

(1) Note. The term "organic acid" includes organic compounds which contain an acid function, e.g., boro, phosphor, sulfa or carboxylic group and see Class 260, Chemistry of Carbon Compounds, subclass 500 "(1) Note".

SEE OR SEARCH THIS CLASS, SUBCLASS:
14, for a separatory distillation process for removing only water from salts or esters of organic acids.

16 Acetic:
This subclass is indented under subclass 15. Processes in which the organic acid is acetic acid.

17 Aldehyde or ketone:
This subclass is indented under subclass 14. Processes in which the organic substance is an aldehyde or a ketone.

(1) Note. The terms "aldehyde" and "ketone" include those compounds having the structure R1COR2 wherein R1 is hydrocarbon and R2 is either hydrogen or hydrocarbon. See Class 568, Organic Compounds, subclasses 303 and 420 and the notes thereunder.

18 Alcohol:
This subclass is indented under subclass 14. Processes in which the organic substance is an alcohol.

(1) Note. For purposes of this and indented subclasses the term "alcohol" is limited to a hydroxy group bonded to carbon.

19 Ethanol:
This subclass is indented under subclass 18. Processes in which the alcohol is ethanol.

20 INCLUDING DEFOAMING OR INHIBITING FOAM:
This subclass is indented under the class definition. Processes directed to defoaming or inhibiting the formation of foam.

SEE OR SEARCH CLASS:
95, Gas Separation: Processes, subclass 155 for processes of gas separation involving liquid contacting and the use of a defoaming or antifoaming agent; subclass 157 for processes of gas separation involving liquid contacting and defoaming the liquid; and subclass 242 for defoaming a liquid, per se.
137, Fluid Handling, appropriate subclasses for apparatus for controlling the degree of foaming in a gas charged liquid.
201, Distillation: Processes, Thermolytic, subclass 9 for a process of surface treating the solid particles of the charge to inhibit, reduce or prevent foaming during distillation.

202, Distillation: Apparatus, subclass 264 for distillation apparatus intended to break foam or inhibit foaming.

435, Chemistry: Molecular Biology and Microbiology, subclass 266 for a fermentation process including the step of treating the foam produced.

516, Colloid Systems and Wetting Agents; Subcombinations Thereof; Processes of Making, Stabilizing, Breaking, or Inhibiting, subclasses 115+ for processes of or compositions for or subcombination compositions for the breaking of or inhibiting of foam colloid systems, when generically claimed or when there is no hierarchically superior provision in the USPC for the specifically claimed art.

21 AND RECOVERING HEAT BY INDIRECT HEAT EXCHANGE:

This subclass is indented under the class definition. Processes directed to recovering waste heat by indirect heat exchange with (1) a disparate source or (2) a product of a distillation step.

(1) Note. Heat generated by an engine which runs a compressor used in the process is a disparate source of "waste heat" within the scope of this and indented subclasses.

SEE OR SEARCH THIS CLASS, SUBCLASS:

100, for a digest of distillation processes directed to specific type of heating.

SEE OR SEARCH CLASS:

34, Drying and Gas or Vapor Contact With Solids, subclasses 427 and 513 for a process including conserving heat by indirect heat exchange.

62, Refrigeration, subclass 96 for a process in which heat from a gas being cooled is transferred to a heat absorber by indirect heat exchange, and subclass 113 for a process of refrigeration in which one function is in heat exchange relation with a second function.

165, Heat Exchange, appropriate subclasses for heat exchange apparatus and note Search Class under Class definition for related fields of search.

196, Mineral Oils: Apparatus, subclass 134 for apparatus for vaporizing mineral oils including means for heat recovery from the vapor or residuum.

202, Distillation: Apparatus, subclass 146 for a horizontal retort with flues wherein the air and/or gas for combustion is heated by the waste products of combustion by means of a single-surface heater and subclass 150 for a similar apparatus using a double-surface heater.

208, Mineral Oils: Processes and Products, subclass 365 for a process wherein the mineral oil distilland is heated by indirect contact with a heated product of the distillation.

237, Heating Systems, appropriate subclass for a heating system which may use the heat rejecting portion of a refrigeration system with additional heating means.

261, Gas and Liquid Contact Apparatus, subclasses 158+ for apparatus for indirect interchange of heat between contact fluids.

22 Utilizing recovered heat for heating feed:

This subclass is indented under subclass 21. Processes in which the feed is heated by the recovered waste heat.

SEE OR SEARCH CLASS:

34, Drying and Gas or Vapor Contact With Solids, subclass 513 for a process of including the step of exchanging heat between the incoming and outgoing gases.

196, Mineral Oils: Apparatus, subclass 134 for mineral oil vaporizing apparatus having means for preheating the oil by the heat of the vapor or residue.

201, Distillation: Processes, Thermolytic, subclasses 14+ for a thermolytic distillation process directed to using a conversion product as an indirect source of heat for heating the feed.

202, Distillation: Apparatus, subclass 159 for a distillation system including a device for heating the feed with a product of the distillation step and subclasses 177+ for a still system

including a device for preheating the feed with a product of the distillation step.

23 Distillation residue as heat source:
This subclass is indented under subclass 22. Processes in which distillation residue is the source of recovered heat.

SEE OR SEARCH CLASS:
208, Mineral Oils: Processes and Products, subclass 353 for a process wherein one component being distilled is heated by indirect heat exchange of a component of the process, usually by the residue.

24 Compressed vapor as heat source:
This subclass is indented under subclass 22. Processes in which compressed vapor is the source of waste heat.

25 Utilizing recovered heat for heating the distillation zone:
This subclass is indented under subclass 21. Processes in which the distillation zone is heated by the recovered waste heat.

SEE OR SEARCH CLASS:
202, Distillation: Apparatus, subclass 174 for multiple effect still series apparatus, 187 for apparatus in which the still and condenser are concentric and 192 for apparatus to which the cooling liquid in the condenser passes to the still to be distilled.

26 Compressed vapor as heat source:
This subclass is indented under subclass 25. Processes in which the source of waste heat is compressed vapor.

27 Utilizing recovered heat in subsequent step in process:
This subclass is indented under subclass 21. Processes in which the recovered waste heat is utilized in a step subsequent to the step in which the heat was produced.

28 WITH CHEMICAL REACTION:
This subclass is indented under the class definition. Processes including the step of producing a chemical reaction of a component of the mixture being separated to facilitate separation of the desired substance in the original mixture.

(1) Note. To come within the purview of this and indented subclasses a chemical change must occur which facilitates the recovery without chemical change of the desired substance which was present in the original mixture.

SEE OR SEARCH CLASS:
208, Mineral Oils: Processes and Products, subclasses 46+ for a process of treating mineral oil which results in a chemical alteration of at least some of the hydrocarbon molecules thereof.
546, Organic Compounds, subclasses 134+ for a general process of chemically treating a carbon compound not otherwise provided for.
588, Hazardous or Toxic Waste Destruction or Containment, subclasses 300 through 320 for the use of a chemical reaction with distillation as part of a process of the destruction of hazardous or toxic waste.

29 Including step of adding catalyst or reacting material:
This subclass is indented under subclass 28. Processes directed to adding a catalyst or a material which reacts with a component of the mixture to assist the separation of the desired component in the original mixture.

(1) Note. A chemical reaction for purposes of this and indented subclasses includes such reactions as (1) forming hydrates, (2) adjusting of hydrogen ion concentration, (3) polymerizing a component, (4) oxidizing or reducing a component or the addition to the mixture being acted upon of an oxidizing or reducing agent, and (5) the forming of different substances.

SEE OR SEARCH THIS CLASS, SUBCLASS:
50+, for adding a substance to alter the relative volatility of components of the incoming feed without specifically producing a new chemical compound.

30 For polymerizing unwanted component:
This subclass is indented under subclass 29. Processes in which the added material causes unwanted material in the feed to enter a reaction forming polymeric material.

SEE OR SEARCH CLASS:
520, Synthetic Resins or Natural Rubbers, subclasses 1+ for a process of polymerizing, per se, and products resulting therefrom.
530, Chemistry: Natural Resins or Derivatives; Peptides or Proteins; Lignins or Reaction Products Thereof, subclasses 211+ for a process polymerizing, per se, and products resulting therefrom.
554, Organic Compounds, subclasses 25 through 29 for a process polymerizing, per se, and products resulting therefrom.
585, Chemistry of Hydrocarbon Compounds, subclasses 502+ for olefin polymerization processes; and subclass 832 for a hydrocarbon purification process which involves polymerization and depolymerization.

31 Oxidizing material:
This subclass is indented under subclass 29. Processes directed to adding an oxidizing substance.

(1) Note. This subclass is limited to incorporating a substance which is stated to oxidize a part of the material being treated or is a well-known oxidizing agent.

(2) Note. Nitric acid is classified here and crossed to subclass 34.

SEE OR SEARCH CLASS:
532, Organic Compounds, appropriate subclasses for a process of purification by an oxidative treatment of a particular carbon compound.
585, Chemistry of Hydrocarbon Compounds, subclasses 833+ for a purification process involving the addition of an oxidizing agent to a hydrocarbon feedstock.

32 Reducing material:
This subclass is indented under subclass 29. Processes directed to adding a reducing substance.

(1) Note. This subclass is limited to incorporating a substance which is stated to reduce a part of the material being treated or is a well known reducing agent, e.g., hydrogen.

SEE OR SEARCH CLASS:
532, Organic Compounds, appropriate subclasses for a process of purifying by a reductive treatment, of a particular carbon compound.
585, Chemistry of Hydrocarbon Compounds, subclasses 258+ and 841 for hydrogenative purification of hydrocarbons.

33 Inorganic salt containing oxygen in the anion:
This subclass is indented under subclass 29. Processes in which the reactive material added is a metal or ammonium salt of an inorganic oxygen containing acid.

(1) Note. This subclass takes acid, neutral and basic salts of oxygen containing inorganic acids, e.g., NaHSO4, Na2SO4, CuCO3, Cu(OH)2.

34 Acid:
This subclass is indented under subclass 29. Processes in which the added material is an acid.

(1) Note. For purposes of this and indented subclasses the term “acid” includes inorganic compounds which contain hydrogen as the cation and under subclass 15 see (1) Note for definition of organic acids.

SEE OR SEARCH THIS CLASS, SUBCLASS:
33, for processes in which the reacting material is a complex inorganic acid salt, e.g., NaHCO3.

35 Phosphoric or sulfuric acid:
This subclass is indented under subclass 34. Processes in which the acid is phosphoric or sulfuric.

36 Alkaline oxide or hydroxide:
This subclass is indented under subclass 29. Processes in which the added material is an alkaline oxide or an alkaline hydroxide.

(1) Note. This subclass is limited to the oxides and hydroxides of alkali metals, alkaline earth metals including magnesium and the scandium group metals.

37 Alkali metal hydroxide:
This subclass is indented under subclass 36. Processes in which the material is an alkali metal hydroxide.

38 Organic material:
This subclass is indented under subclass 29. Processes in which the added material is organic.

(1) Note. To come within the purview of this subclass an organic compound must be clearly disclosed to react with a component of the mixture being treated to form a new compound.

(2) Note. See class definition of Class 260, Chemistry of Carbon Compounds, for the scope of the term "organic".

(3) Note. A separatory distillation process of adding an organic compound, such as an alcohol or an acid, to form in situ an ester which assists separation is classified here and cross-referenced to the appropriate indented subclass under subclass 57.

39 WITH DISPARATE PHYSICAL SEPARATION:
This subclass is indented under the class definition. Processes combined with subjecting the material being vaporized, the vapor, the distillate or the residue to a disparate physical treatment to remove a substance.

(1) Note. A process merely including the step of separating the immiscible layers of the distillate, e.g., decanting, is not considered a disparate separation for this and indented subclasses.

SEE OR SEARCH THIS CLASS, SUBCLASS:

50+, for a separatory distillation process including the step of separating the distillate layers in an azeotropic type distillation and subclasses 76, 79, 83, 85, 92+, and 95+, when the azeotroping agent is water only.

SEE OR SEARCH CLASS:

23, Chemistry: Physical Processes, subclasses 293+ for a general physical process not otherwise classified and under subclass 293, see "SEARCH THIS CLASS, SUBCLASS" and "SEARCH CLASS" for related fields of search.

95, Gas Separation: Processes, for processes of gas separation, per se.

201, Distillation: Processes, Thermolytic, subclasses 3+ for a process of physical separating of a solid in the removed by product mixture.

208, Mineral Oils: Processes and Products, subclass 369 for a process of distilling mineral oil involving some noncondensation treatment of the volatiles evolved during distillation and subclass 349 for a process in which the liquid condensate or the residue resulting from the distillation is subjected to a nonvaporizing treatment.

585, Chemistry of Hydrocarbon Compounds, subclasses 802+ for hydrocarbon purification by plural serial diverse separations.

40 Of entrained particles from a vapor or gas:
This subclass is indented under subclass 39. Processes directed to removing entrained solid or liquid particles from gas or vapor in the distillation operation.

SEE OR SEARCH CLASS:

95, Gas Separation: Processes, for processes, per se, of removing solid or liquid particles entrained in a gas.

122, Liquid Heaters and Vaporizers, subclass 492 for a device in the steam dome of a boiler for separating water from steam.

137, Fluid Handling, subclasses 544+ for fluid handling apparatus including means for separating solid material from a fluid and see "SEARCH THIS CLASS, SUBCLASS" and "SEARCH CLASS" under subclass 544 for related fields of search.

202, Distillation: Apparatus, subclass 197 for apparatus in which vapor deposits entrained solid or liquid particles.

209, Classifying, Separating, and Assorting Solids, subclasses 19 through 37 and 133+ for a process of using free suspension in a gas or separating solid components of a mixture.

41 Utilizing solid sorbent:

This subclass is indented under subclass 39. Processes directed to material being treated being acted upon with a solid sorbent to assist separation of a desired product.

(1) Note. The sorbent must contact the distilland during distillation or a product of the distillation step.

SEE OR SEARCH CLASS:

95, Gas Separation: Processes, subclasses 90+ for processes, per se, of gas separation utilizing solid sorption.

202, Distillation: Apparatus, subclass 200 for distillation apparatus in which the vapor is passed through porous material or other porous material.

208, Mineral Oils: Processes and Products, subclass 310 for a process wherein a mineral oil containing fluid is contacted with a solid sorptive material, and note "SEARCH THIS CLASS, SUBCLASS" and "SEARCH CLASS" thereunder.

210, Liquid Purification or Separation, subclasses 660+ for a process of purifying a liquid by sorption.

502, Catalyst, Solid Sorbent, or Support Therefor: Product or Processes of Making, subclasses 60+ and 400+ for a sorbent composition.

42 Utilizing liquid sorption of component from gas or vapor:

This subclass is indented under subclass 39. Processes directed to extracting a component from gas or vapor with a liquid.

SEE OR SEARCH CLASS:

95, Gas Separation: Processes, subclasses 149+ for processes, per se, of gas separation utilizing liquid contacting.

208, Mineral Oils: Processes and Products, subclass 311 for a process in which mineral oil is mixed with a liquid which will form with a portion of the oil a liquid phase which is immiscible with the rest of the oil and note "SEARCH THIS CLASS, SUBCLASS" and "SEARCH CLASS" thereunder.

261, Gas and Liquid Contact Apparatus, appropriate subclasses for apparatus for contacting a gas and a liquid.

532, Organic Compounds, appropriate subclasses for a process including treatment for absorbing impurities.

585, Chemistry of Hydrocarbon Compounds, subclasses 833+ for hydrocarbon purification by solvent extraction.

43 Utilizing liquid-liquid extracting of distillation product:

This subclass is indented under subclass 39. Processes directed to extracting a liquid product of a distillation step with a liquid.

(1) Note. The extraction with a liquid must take place subsequent to the vaporization of the distilland. The liquid extracted may be the initial distillate or residue or a product of a subsequent distillation operation.

SEE OR SEARCH CLASS:

23, Chemistry: Physical Processes, subclasses 306+ for process of concentrating a liquid in liquid.

95, Gas Separation: Processes, subclass 190 for processes, per se, of gas separation utilizing liquid contacting and separation of liquid from the contact liquid by liquid-liquid extraction.

208, Mineral Oils: Processes and Products, subclasses 311+ for a process in which mineral oil is mixed with or contacted with another liquid which will dissolve or is miscible with a portion or fraction of the oil and by so doing forming a liquid phase which is immiscible with another portion or fraction, particularly subclass 339 and under subclass 311 see "SEARCH THIS CLASS, SUBCLASS" and "SEARCH CLASS" for related fields of search.

210, Liquid Purification or Separation, subclasses 634+ for a process of extracting a solute from a liquid solution by contacting the solution with a second liquid.

260, Chemistry of Carbon Compounds, and its daughter Classes 530-570 appropriate subclasses for a process of isolating or purifying a nonhydrocarbon carbon compound including a liquid extraction step and for a process including extracting a carbon compound from a mixture.

423, Chemistry of Inorganic Compounds, appropriate subclasses for a process of isolating or purifying an inorganic compound by an extracting, leaching or dissolving step.

424, Drug, Bio-Affecting and Body Treating Compositions, for a process of producing a composition of that class and which may include an extraction step. See especially subclasses 123+, 195.15-195.17, 520+, and 725-780.

426, Food or Edible Material: Processes, Compositions, and Products, subclasses 425+ for extracting or using a liquid as an extracting medium.

585, Chemistry of Hydrocarbon Compounds, subclasses 833+ for hydrocarbon purification by solvent extraction.

44 Of distillate:

This subclass is indented under subclass 43. Processes in which the extracted liquid is a distillate.

45 And distilling raffinate phase:

This subclass is indented under subclass 44. Processes directed to distilling the distillate after it has been extracted with a liquid.

(1) Note. The raffinate phase is that part of the distillate which does not dissolve in the extracting liquid during the liquid extraction step.

SEE OR SEARCH THIS CLASS, SUBCLASS:

74+, and 81+, for a plural separatory distillation process in which the initial distillate is distilled.

46 And distilling extractant phase:

This subclass is indented under subclass 44. Processes directed to distilling the extracting liquid phase subsequent to the extraction step.

(1) Note. The extracting liquid phase is the liquid composed of the extracting liquid and the portion of the distillate soluble therein.

47 Utilizing removing solid from liquid:

This subclass is indented under subclass 39. Processes directed to separating a solid material from a product of the distillation step.

SEE OR SEARCH CLASS:

210, Liquid Purification or Separation, subclasses 600+ for a process of separating a solid from a liquid, especially subclasses 702+ for an accretion or precipitation process; and subclasses 767+ for a skimming, settling, or filtration process.

48 By crystallizing:

This subclass is indented under subclass 47. Processes directed to crystallizing a component from a product of the distillation step.

(1) Note. The fact that the solid material is crystalline must be stated in the claim.

SEE OR SEARCH CLASS:

23, Chemistry: Physical Processes, subclasses 295+ for a process including crystallization and under subclass

295, see "SEARCH CLASS" for related crystallization processes.

127, Sugar, Starch, and Carbohydrates, subclasses 58+ for a process of crystallizing sugar from a solution.

532, Organic Compounds, appropriate subclasses for a process of physically treating an organic compound which includes the step of crystallizing.

585, Chemistry of Hydrocarbon Compounds, subclasses 812+ for a hydrocarbon separation or purification process which includes chilling to form a solid.

49 CONVECTIVE DISTILLATION WITH NORMALLY GASEOUS MEDIUM, E.G., AIR:

This subclass is indented under the class definition. Processes directed to passing through the material being distilled a normally gaseous substance.

(1) Note. A substance to be considered "normally gaseous" must have a boiling point below - 10oC at atmospheric pressure. Air, ammonia, carbon dioxide, dimethyl ether and propane are some examples of "normally gaseous" substances.

SEE OR SEARCH CLASS:

23, Chemistry: Physical Processes, subclass 307 for a process of concentrating a solution of a liquid in a liquid in which the liquid being concentrated is directly contacted with the concentrating medium (e.g., hot gases).

95, Gas Separation: Processes, subclasses 263+ for degasification of a liquid by stripping with a gas.

202, Distillation: Apparatus, subclass 134 for a retort having provision for injecting a fluid for convective separation of the distillate.

208, Mineral Oils: Processes and Products, subclasses 356 and 362 for a process of distilling mineral oil in the presence of an added gas or vapor, and subclass 43 for a process of contacting tar with high temperature gas during distillation.

261, Gas and Liquid Contact Apparatus, appropriate subclasses for apparatus adapted to produce an intimate contact between gases and liquids, particularly subclasses 121.1+ for devices for discharging gases beneath the surface of a liquid.

50 ADDING MATERIAL TO DISTILLAND EXCEPT WATER OR STEAM PER SE:

This subclass is indented under the class definition. Processes including the step of adding material other than water or steam per se to the distilland or distillation zone.

(1) Note. This subclass and indented subclasses include azeotropic and extractive distillations in which additional material other than water or steam alone is added to alter the relative volatility of components of the distilland to assist the distillative separation. Usually the material is added to the distilland or the distillation zone. Recycling all or part of a product of the distillation is not considered adding an additional material for purposes of this and indented subclasses.

(2) Note. The use of water or steam in addition to the added material is within the scope of this and indented subclasses.

(3) Note. When two or more distinct species of added substance are claimed, the patent is placed in the subclass first providing for a species. When a species claimed is not specifically provided for, the patent is placed in the generic subclass (50 or 57) and cross-references to the subclasses providing for the other species.

(4) Note. See Class 260, Chemistry of Carbon Compounds, class definitions, Definition of Terms Employed in this Class, and appropriate subclasses for definitions of terms for organic compounds used in this and indented subclasses.

SEE OR SEARCH THIS CLASS, SUBCLASS:

12+, for a process for reducing only the water content of the distilland in which additional material assists the

distillative separation and subclasses 76, 79, 83, 85, 92+, and 95+ for a separatory distillation process in which only water or steam is the additional material added.

29+, for a separatory distillation process in which the added material reacts with a component of the material being separated or catalyzes a chemical reaction.

39+, for a distillation process in which an extraneous material is utilized to assist a disparate physical separation such as extraction or sorption.

SEE OR SEARCH CLASS:

208, Mineral Oils: Processes and Products, subclasses 356 and 362 for a process of distilling mineral oil in the presence of an added gas or vapor, and subclass 313 for a process of distilling mineral oil in the presence of a selective solvent. Under subclass 362 see "SEARCH THIS CLASS, SUBCLASS" and "SEARCH CLASS" for related fields of search.

51 At least two materials:

This subclass is indented under subclass 50. Processes in which plural materials are added.

(1) Note. Each of the added materials may be repeatedly added to the distilland at different points in the same distillation zone, for the purpose of this subclass.

(2) Note. When a series of distillations is carried out and a different substance is added in separate distillations, the process is treated as adding a single substance and classified under subclass 50 according to the claimed added substance first appearing.

52 Mixtures of hydrocarbons:

This subclass is indented under subclass 51. Processes in which a mixture of hydrocarbons is added.

(1) Note. Benzine, gasoline and kerosene are examples of hydrocarbon mixtures.

SEE OR SEARCH CLASS:

208, Mineral Oils: Processes and Products, subclasses 14+ for mineral oil mixtures.

53 One material is water:

This subclass is indented under subclass 51. Processes in which the additional material comprises water or stream and at least one other substance.

(1) Note. For purposes of this and indented subclasses the plural component mixture added includes a solution, a suspension, or water and at least one other substance added separately to produce a complementary result.

54 A second material is aldehyde or ketone:

This subclass is indented under subclass 53. Processes in which another substance comprises an aldehyde or a ketone.

55 A second material is an alcohol:

This subclass is indented under subclass 53. Processes in which the other substance comprises an alcohol.

56 One additive an alcohol or ether:

This subclass is indented under subclass 51. Processes in which the additional material comprises an alcohol or an ether and at least one other substance.

57 Organic compound:

This subclass is indented under subclass 50. Processes in which the additional material is an organic compound.

(1) Note. See Class 260, Chemistry of Carbon Compounds, Class Definitions, Definitions of Terms Employed In This Class, and appropriate subclasses for definitions of terms used in this and indented subclasses.

SEE OR SEARCH CLASS:

260, Chemistry of Carbon Compounds, appropriate subclass for a particular nonhydrocarbon organic compound.

585, Chemistry of Hydrocarbon Compounds, subclasses 16+ for a hydrocarbon compound per se, and sub-

classes 864+ for hydrocarbon purification involving use of an organic agent.

58 Heterocyclic:
This subclass is indented under subclass 57. Processes in which the organic compound is heterocyclic.

(1) Note. The term heterocyclic denotes the presence of a ring whose members are composed of at least one carbon atom and one or more atoms of the elements taken from the group consisting of nitrogen, oxygen, sulfur, selenium and tellurium.

(2) Note. Carbohydrates and their derivatives unless shown to be acyclic are presumed to be heterocyclic compounds.

SEE OR SEARCH THIS CLASS, SUBCLASS:
57, for a distillation process utilizing a ring oregano boron or oregano phosphorus compound.

SEE OR SEARCH CLASS:
208, Mineral Oils: Processes and Products, subclasses 325+ for a process of fractionating mineral oil in which a heterocyclic organic compound is a selective solvent.

59 Amine:
This subclass is indented under subclass 57. Processes in which the organic compound is an amine.

(1) Compounds containing amino and other functional groups are classified here and cross-referenced to the other functional groups appearing below.

60 Ester:
This subclass is indented under subclass 57. Processes in which the organic compound is an ester.

(1) Note. For purposes of this subclass the term “ester” includes amide and nitrite.

SEE OR SEARCH THIS CLASS, SUBCLASS:
38, for a separatory distillation process in which an organic acid or an alcohol is added to form in situ an ester which aids separation by changing the relative volatility of components of the distilland.

61 Acid:
This subclass is indented under subclass 57. Processes in which the organic compound is an acid.

SEE OR SEARCH THIS CLASS, SUBCLASS:
15, for the scope of the term “and”.

62 Aldehyde or ketone:
This subclass is indented under subclass 57. Processes in which the organic compound is an aldehyde or a ketone.

SEE OR SEARCH THIS CLASS, SUBCLASS:
17, for the meaning of “aldehyde” and “ketone”.

63 Alcohol or ether:
This subclass is indented under subclass 57. Processes in which the compound is an alcohol or an ether.

(1) Note. As used in this and indented subclasses the term “alcohol” includes the monohydroxy and polyhydroxy organic compounds such as: butanol, glycol, glycerol, sorbitol, cyclohexanol, phenol, (ROH).

(2) Note. As used in this and indented subclasses the term “ether” includes organic compounds in which the hydrogen of at least one alcohol group has been replaced by a hydrocarbon radical.

SEE OR SEARCH THIS CLASS, SUBCLASS:
57, for a process using a mercaptan (thiol alcohol) or an organic sulfide (thiol ether) without other significant groups.

59, for a process in which the added material is an amino alcohol.

64 Polyhydroxy alcohol or ether derivative thereof:
This subclass is indented under subclass 63. Processes in which the compound is polyhydroxy alcohol or an ether derivative thereof.

65 Hydroxy aromatic (e.g., Phenol):
This subclass is indented under subclass 63. Processes in which the organic compound is a hydroxy aromatic, e.g., phenol, naphthol, cresol.

66 Methanol:
This subclass is indented under subclass 63. Processes in which the alcohol is methanol.

67 Halogenated hydrocarbon:
This subclass is indented under subclass 57. Processes in which the compound is a halogenated hydrocarbon.

(1) Note. Organic compounds which contain only carbon, hydrogen and halogen are halogenated hydrocarbons.

SEE OR SEARCH CLASS:
570, Organic Compounds, subclasses 101+ for compounds which contain halogen bonded to carbon.

68 Hydrocarbon:
This subclass is indented under subclass 57. Processes in which the compound is a hydrocarbon.

(1) Note. For purposes of this and indented subclasses the term "hydrocarbon" is limited to compounds consisting of carbon and hydrogen.

SEE OR SEARCH THIS CLASS, SUBCLASS:
12+, for a process of separating only water in which a hydrocarbon is the azeotroping agent.
43+, for a process in which the extracting liquid is a hydrocarbon.
52, for a process of adding a mixture of hydrocarbons to assist separation during distillation.

SEE OR SEARCH CLASS:
208, Mineral Oils: Processes and Products, subclass 337 for a process of fractionating mineral oil using a hydrocarbon as a solvent.
585, Chemistry of Hydrocarbon Compounds, appropriate subclasses for compounds which consist of carbon and hydrogen only.

69 Aromatic:
This subclass is indented under subclass 68. Processes in which the hydrocarbon is aromatic.

(1) Note. A compound consisting of carbon and hydrogen characterized by the presence of a benzene nucleus is an aromatic hydrocarbon.

SEE OR SEARCH CLASS:
585, Chemistry of Hydrocarbon Compounds, subclasses 16 and 18 for a hydrocarbon which contains a benzene nucleus.

70 Acyclic:
This subclass is indented under subclass 68. Processes in which the hydrocarbon is acyclic.

(1) Note. A compound consisting of carbon and hydrogen and having an open chain structure, only, is an acyclic hydrocarbon.

SEE OR SEARCH CLASS:
585, Chemistry of Hydrocarbon Compounds, subclasses 16 and 18 for a hydrocarbon which is acyclic.

71 PLURAL DISTILLATIONS PERFORMED ON SAME MATERIAL:
This subclass is indented under the class definition. Processes directed to utilizing at least two distilling operations to separate components present in the original mixture.

(1) Note. The second distilling operation may be performed on all or a part of a distillate, a side stream or a residue from the initial distilling operation.

(2) Note. For purposes of this and indented subclasses an operation is considered to be a plural operation if (a) a part of a distilland is removed by distillation and the residue in the still is further distilled under a different pressure or with the addition or absence of water or steam and (b) two or more distillation systems are used regardless as to whether there is an intermediate condensation.

SEE OR SEARCH THIS CLASS, SUBCLASS:

21+, for a plural distillation process in which useful heat is recovered by indirect heat exchange.

43, for a plural distillation process in which a residue of a distillation operation is extracted with a liquid.

44+, for a plural distillation process in which a distillate of a distillation operation is extracted with a liquid.

SEE OR SEARCH CLASS:

23, Chemistry: Physical Processes, subclass 306 for a process of concentrating a solution of a liquid in a liquid not otherwise provided for.

159, Concentrating Evaporators, subclasses 47.1+, for a process of concentrating a liquid, and see "SEARCH CLASS" thereunder for related fields of search.

196, Mineral Oils: Apparatus, subclasses 105+ for a plurality of interconnected mineral oil vaporizers.

202, Distillation: Apparatus, subclasses 154 and 155 for separatory distillation apparatus having plural columns and/or plural stills and subclass 173 for a plurality of stills so connected that either the vapor or the residue of one flows into the other.

208, Mineral Oils: Processes and Products, subclasses 354+ and 364+ for a process of distilling mineral oil wherein the vaporization is carried out in a plurality of separate and distinct operations.

72 One a filming distillation:

This subclass is indented under subclass 71. Processes in which at least one distilling operation is directed to introducing the distilland into the vaporization zone by spreading it as a thin film over a surface.

(1) Note. The surface on which the distilland is spread may be liquid, solid or foraminous.

SEE OR SEARCH THIS CLASS, SUBCLASS:

89, for a process involving a single distillation operation in which the distilland is spread as a thin film over a surface.

SEE OR SEARCH CLASS:

159, Concentrating Evaporators, subclasses 5+ for concentrating apparatus of the film type including subclasses 13.1+ for evaporating apparatus designed to maintain the liquid being evaporated in a film and subclass 49 for an evaporating process in which the liquid to be concentrated is spread in a thin film.

196, Mineral Oils: Apparatus, subclass 128 for vaporizing apparatus for distilling mineral oil in a thin film.

202, Distillation: Apparatus, subclass 236 for separatory distillation apparatus in which the still has means for introducing the distilland into the still in the form of a spray or the distilland is introduced into the still in the form of a film.

208, Mineral Oils: Processes and Products, subclass 360 for a process of distilling mineral oil wherein the oil is spread as a thin film on a surface.

73 One a distillation under positive pressure or vacuum:

This subclass is indented under subclass 71. Processes in which at least one distillation operation is carried out under a pressure greater than atmospheric or under a vacuum.

SEE OR SEARCH THIS CLASS, SUBCLASS:

43, for a distillation separatory process in which the initial residue is extracted with a liquid.

91+, for a single distillation process carried out at a pressure greater or less than atmospheric pressure and see "SEARCH CLASS" under subclass 91 for related fields of search.

SEE OR SEARCH CLASS:

202, Distillation: Apparatus, subclass 205 for a separatory distillation system provided with means for producing a vacuum therein.

74 Distillation of initial distillate:

This subclass is indented under subclass 73. Processes in which at least a portion of the distillate from the initial distillation operation is subjected to at least one subsequent distillation operation.

SEE OR SEARCH THIS CLASS, SUBCLASS:

45, and 46, for a process of separatory distillation including extracting a distillate with an immiscible liquid.

75 And return of distillation product to a previous distillation zone:

This subclass is indented under subclass 74. Processes in which a product from a later distillation operation is returned in terms of the process to a distillation zone prior to the distillation zone in which the product was produced.

(1) Note. The prior distillation zone must be in the series of distillation operations which produced the product being returned.

(2) Note. The product returned may be all or a part of a product of a second or subsequent distillation operation in a series.

SEE OR SEARCH CLASS:

165, Heat Exchange, subclasses 104.21+ for apparatus in which liquid is vaporized at one zone, condensed at another and the condensate is returned to the first zone.

196, Mineral Oils: Apparatus, subclass 99 for mineral oil distilling apparatus including the combination of a vaporizer, condensing means with means for returning a part or all of the condensate to the vaporizer.

208, Mineral Oils: Processes and Products, subclass 355 for a process of subjecting mineral oil to at least two distillation operations in which either vapors, condensate, and/or residue from a later distillation zone is returned to an earlier distillation zone.

76 Including the addition of water or steam:

This subclass is indented under subclass 74. Processes directed to adding water or steam to at least one distillation operation.

(1) Note. Water or steam is usually added to the distillation operation to change the relative volatility of the components of the material being distilled.

77 Initial distillation under positive pressure or vacuum:

This subclass is indented under subclass 74. Processes in which the initial distillation is carried out under a pressure greater than atmospheric or under a vacuum.

78 And returning distillation product to a previous distillation zone:

This subclass is indented under subclass 73. Processes in which a product from a later distillation operation is returned in term of the process to a distillation zone prior to the distillation zone in which the product was produced.

SEE OR SEARCH CLASS:

196, Mineral Oils: Apparatus, subclass 99 for mineral oil distilling apparatus including the combination of a vaporizer, condensing means with means for returning a part or all of the condensate to the vaporizer.

208, Mineral Oils: Processes and Products, subclass 355 for a process of subjecting mineral oil to at least two distillation operations in which either vapors, condensate, and/or residue from a

later distillation zone is returned to an earlier distillation zone.

79 Including the addition of water or steam:
This subclass is indented under subclass 73. Processes directed to adding water or steam to at least one distillation operation.

(1) Note. Water or steam is usually added to the distillation operation to change the relative volatility of the components of the material being distilled.

SEE OR SEARCH THIS CLASS, SUBCLASS:
95+, for a single distillation process in which water is added and under subclass 95, see "SEARCH CLASS" for related fields of search.

80 Initial distillation under positive pressure or vacuum:
This subclass is indented under subclass 73. Processes in which the initial distillation is carried out under a pressure greater than atmospheric or under a vacuum.

SEE OR SEARCH THIS CLASS, SUBCLASS:
77, for a process including the step of distilling the initial distillate in which the initial distillation is under a pressure greater or less than atmospheric pressure.

81 Distillation of initial distillate:
This subclass is indented under subclass 71. Processes directed to distilling all or a part of the distillate from the initial distillation operation.

(1) Note. The term "distillate" includes the portion of the incoming feed which is taken off "overhead" or taken off as a "side stream".

SEE OR SEARCH THIS CLASS, SUBCLASS:
43, for a separatory distillation process in which the initial residue is extracted with a liquid.
45, and 46, for a plural distillation process including extracting a distillate with a liquid and distilling the raffinate phase or the extractant phase.

82 And returning distillation product to a previous distillation zone:
This subclass is indented under subclass 81. Processes including returning a product from a second or subsequent distillation operation in a series to an earlier distillation in the series.

SEE OR SEARCH CLASS:
196, Mineral Oils: Apparatus, subclass 99 for mineral oil distilling apparatus including the combination of a vaporizer, condensing means with means for returning a part or all of the condensate to the vaporizer.
208, Mineral Oils: Processes and Products, subclass 355 for a process of subjecting mineral oils to at least two distillation operations including returning vapor, condensate, and/or residue from a later distillation to an earlier distillation zone.

83 Including the addition of water or steam:
This subclass is indented under subclass 81. Processes directed to adding water or steam to at least one distillation operation.

(1) Note. Water or steam is usually added to the distillation operation to change the relative volatility of the components of the material being distilled.

84 And returning distillation product to a previous distillation zone:
This subclass is indented under subclass 71. Processes which includes returning a product from a later distillation operation to a distillation zone prior to the distillation zone in which the product was produced.

SEE OR SEARCH THIS CLASS, SUBCLASS:
43, for a separatory distillation process in which the initial residue is extracted with a liquid.
75, 78, 82, for other plural distillation processes in which at least a portion of a product of a second or subsequent distillation step is returned to a distillation zone prior to the one in which the product was produced and sub-

class 98, in which a separated product of a single separatory distillation operation is returned to the distillation zone.

SEE OR SEARCH CLASS:

196, Mineral Oils: Apparatus, subclass 99 for mineral oil distilling apparatus including the combination of a vaporizing and condensing means with means for returning a part or all of the condensate to the vaporizer.

208, Mineral Oils: Processes and Products, subclass 355 for processes in which mineral oil is subjected to at least two distillation operations in which either vapors, condensate, and/or residue from a later distillation zone is returned to an earlier distillation zone.

85 Including the addition of water or steam:

This subclass is indented under subclass 71. Processes directed to adding water or steam to at least one distillation operation.

SEE OR SEARCH THIS CLASS, SUBCLASS:

43, for a separatory distillation process in which the initial residue is extracted with a liquid.

72, 76, 79, and 83, for other plural distillation processes in which water or steam is added.

95+, for a single distillation process in which water or steam is added.

86 DISTILLATION IN APPARATUS OR ELEMENT OF SPECIFIC MATERIAL:

This subclass is indented under the class definition. Processes directed to distilling in a system in which all or a part thereof is recited as being made of a specific material.

(1) Note. Processes within the purview of this subclass must recite only a single distillation step in which the composition of the system or a part thereof is recited. For example, broadly distilling using a glass column.

(2) Note. The mere recitation in a claim that an apparatus is metal does not bring it within the purview of this subclass, but the recitation in the claim that the column filling material is chrome steel balls or beryl saddles does.

SEE OR SEARCH THIS CLASS, SUBCLASS:

6+, for a process of adding a material to inhibit or prevent chemical change which may or may not function to coat the system.

SEE OR SEARCH CLASS:

55, Gas Separation, subclasses 522+ for gas separation apparatus in which the composition of the apparatus is recited.

106, Compositions: Coating or Plastic, appropriate subclass for a composition for coating the surfaces of the distilling apparatus.

196, Mineral Oils: Apparatus, subclass 133 for a mineral oil vaporizing system having some special feature of construction.

201, Distillation: Processes, Thermolytic, subclass 18 for a process of destructive distillation utilizing apparatus of a particular composition.

202, Distillation: Apparatus, subclasses 267.1+, in which the apparatus is recited in terms of the materials of construction.

266, Metallurgical Apparatus, subclasses 280+ for the lining construction for metallurgical receptacles.

520, Synthetic Resins or Natural Rubbers, subclasses 1+ for a synthetic resin or a composition containing a synthetic resin for coating distilling apparatus.

87 WITH FRACTIONAL CONDENSATION OF VAPOR OUTSIDE STILL:

This subclass is indented under the class definition. Processes directed to condensing the vapor evolved during the distillation step in a plurality of fractions.

(1) Note. To come within the purview of this subclass a mixed vapor must be produced which is separated into parts by cooling the vapor in a plurality of distinct stages.

SEE OR SEARCH CLASS:

201, Distillation: Processes, Thermolytic, subclass 30 for a thermolytic distillation process in which the evolved vapors are condensed in a plurality of distinct stages.

202, Distillation: Apparatus, subclass 199 for apparatus in which vapor is passed through a condensate from itself to surrender high boiling constituents.

208, Mineral Oils: Processes and Products, subclass 342 for a process including fractionally condensing a mineral oil containing vapor mixture.

88 FLASH VAPORIZATION OF DISTILLAND:

This subclass is indented under the class definition. Processes directed to heating the distilland under pressure high enough to prevent ebullition and the heated distilland is then introduced into a zone of lesser pressure resulting in the volatilizing of at least a portion of the distilland.

SEE OR SEARCH CLASS:

159, Concentrating Evaporators, subclasses 2.1+ for a flash evaporator.

202, Distillation: Apparatus, subclass 177 for a separatory still with a preheater.

208, Mineral Oils: Processes and Products, subclass 352 and 361 for a process of separating mineral oil wherein the distilland is heated under pressure high enough to prevent ebullition and the heated distilland is then introduced into a zone of lesser pressure.

89 FILMING OF DISTILLAND FOR VAPORIZATION:

This subclass is indented under the class definition. Processes directed to introducing the distilland into the vaporization zone by spreading it as a thin film over a surface.

(1) Note. The surface on which the distilland is spread may be liquid, solid or foraminous.

SEE OR SEARCH CLASS:

159, Concentrating Evaporators, subclasses 5+ for concentrating apparatus of the film type including subclasses 13+ for evaporating apparatus designed to maintain the liquid being evaporated in a film and subclass 49 for an evaporating process in which the liquid to be concentrated is spread in a thin film.

196, Mineral Oils: Apparatus, subclass 128 for vaporizing apparatus for distilling mineral oil in a thin film.

202, Distillation: Apparatus, subclass 236 for separatory distillation apparatus in which the still has means for introducing the distilland into the still in the form of a spray or in the form of a film.

208, Mineral Oils: Processes and Products, subclass 360 for a process of introducing mineral oil into the vaporization zone by spreading it as a thin film over a surface. See also "SEARCH CLASS" thereunder for related fields of search.

90 SPRAYING OF DISTILLAND INTO VAPORIZATION ZONE:

This subclass is indented under the class definition. Processes directed to spraying the distilland into the vaporization zone.

SEE OR SEARCH THIS CLASS, SUBCLASS:

88, for a separatory distillation process in which heated distilland under pressure is introduced into a zone of lesser pressure resulting in the volatilization of at least a portion of the distilland.

SEE OR SEARCH CLASS:

159, Concentrating Evaporators, subclasses 48.1+ for a process for concentrating in which the liquid being concentrated is reduced to a spray; and subclasses 3+ for concentrating apparatus of the spray type.

202, Distillation: Apparatus, subclass 236 for separatory distillation apparatus in which the still has means for introducing the distilland into the still in the form of a spray.

208, Mineral Oils: Processes and Products, subclass 359 for a process of distilling mineral oil in which the distilland is sprayed into the vaporization zone

and see "SEARCH CLASS" thereunder for related fields of search.

91 VAPORIZATION ZONE UNDER POSITIVE PRESSURE OR VACUUM:
This subclass is indented under the class definition. Processes in which distillation is carried out under a pressure greater than atmospheric or under a vacuum.

(1) Note. The use of pressure varying from atmospheric changes the relative volatility of the components of the distilland thereby altering the composition of the vapor evolved.

SEE OR SEARCH CLASS:
34, Drying and Gas or Vapor Contact With Solids, subclasses 402+ for a process of drying a solid involving the application of a vacuum.
196, Mineral Oils: Apparatus, subclass 114 for mineral oil vaporizing apparatus operated under vacuum.
201, Distillation: Processes, Thermolytic, subclass 35 for a process of applying differential pneumatic pressure to the thermolytic conversion zone.
202, Distillation: Apparatus, subclass 205 for separatory distillation apparatus provided with means for producing a vacuum therein and see "SEARCH CLASS" thereunder for related fields of search.
208, Mineral Oils: Processes and Products, subclasses 357 and 366 for a process of distilling mineral oil in which the vaporization zone is under a pressure greater or less than atmospheric pressure and see "SEARCH CLASS" under subclass 357 for related fields of search.
588, Hazardous or Toxic Waste Destruction or Containment, subclasses 300 through 321 for the use of heat or vacuum in the destruction of hazardous or toxic waste.

92 Including the addition of water or steam:
This subclass is indented under subclass 91. Processes directed to adding water or steam to the distillation operation.

(1) Note. Water or steam is usually added to the distillation operation to change the relative volatility of the components of the material being distilled.

93 And returning product of distillation step to distillation zone:
This subclass is indented under subclass 92. Processes directed to returning a product to the distillation zone.

SEE OR SEARCH CLASS:
196, Mineral Oils: Apparatus, subclass 99 for mineral oil distilling apparatus including the combination of vaporizing and condensing means with means for returning a part or all of the condensate to the vaporizer.

94 And returning product of distillation step to distillation zone:
This subclass is indented under subclass 91. Processes directed to returning a product of the distillation operation to the distillation zone.

(1) Note. To be considered a product of distillation for purposes of this subclass an overhead vapor or side stream must be condensed to a liquid before being returned to the distillation zone. In other words to be considered a "product" the substance must be isolated outside the distillation zone.

SEE OR SEARCH CLASS:
208, Mineral Oils: Processes and Products, subclass 358 for a mineral oil distillation process in which condensate or residue is returned to the rectification zone after having been removed therefrom to assist in the separation process.

95 INCLUDING ADDITION OF WATER OR STEAM:
This subclass is indented under the class definition. Processes directed to adding water or steam to the distillation operation.

(1) Note. Water or steam is usually added to the distillation operation to change the relative volatility of the components of the material being distilled.

SEE OR SEARCH CLASS:

196, Mineral Oils: Apparatus, subclass 126 and 127 for mineral oil vaporizing apparatus having means to inject gas or vapor into the vaporization zone.

208, Mineral Oils: Processes and Products, subclasses 348, 356 and 362+ for a process in which a gas or vapor is employed to affect volatilization of the distilland.

588, Hazardous or Toxic Waste Destruction or Containment, subclass 312 wherein the use of water or steam is used in the destruction of hazardous or toxic waste.

96 To distillation column:

This subclass is indented under subclass 95. Processes in which the water or steam is added to the distillation column.

97 And returning product of distillation step to distillation zone:

This subclass is indented under subclass 95. Processes in which a product of the distillation operation is returned to the distillation zone.

(1) Note. To be considered a product of distillation for purposes of this subclass an overhead vapor or side stream must be condensed to a liquid before being returned to the distillation zone. In other words to be considered a "product" the substance must be isolated outside the distillation zone.

SEE OR SEARCH CLASS:

196, Mineral Oils: Apparatus, subclass 99 for mineral oil distilling apparatus including the combination of vaporizing and condensing means with means for returning a part or all of the condensate to the vaporizer.

208, Mineral Oils: Processes and Products, subclass 358 for a mineral oil distillation process in which condensate or residue is returned to the rectification zone after having been removed therefrom to assist in the vaporization process.

98 AND RETURNING PRODUCT OF DISTILLATION STEP TO DISTILLATION ZONE:

This subclass is indented under the class definition. Processes directed to returning a product of the distillation operation to the distillation zone.

(1) Note. To be considered a product of distillation for purposes of this subclass an overhead vapor or side stream must be condensed to a liquid before being returned to the distillation zone. In other words to be considered a "product" the substance must be isolated outside the distillation zone.

SEE OR SEARCH THIS CLASS, SUBCLASS:

165, Heat Exchange, subclasses 104.21+ apparatus in which liquid is vaporized in one zone, condensed in another and the condensate is returned to the first zone.

196, Mineral Oils: Apparatus, subclass 99 for mineral oil distilling apparatus including the combination of vaporizing and condensing means and means for returning a part or all of the condensate to the vaporizer.

208, Mineral Oils: Processes and Products, subclass 358 for a mineral oil distillation process in which condensate or residue is returned to the rectification zone after having been removed therefrom to assist in the vaporization process.

99 MISCELLANEOUS SEPARATORY:

This subclass is indented under the class definition. Processes not otherwise provided for.

(1) Note. In this subclass are distillation combinations not provided for above and not provided for elsewhere.

SEE OR SEARCH CLASS:

23, Chemistry: Physical Processes, subclass 306 for a process of concentrating a solution of a liquid in a liquid not otherwise provided for.

99, Foods and Beverages: Apparatus, subclass 78 for a process of preparing a beverage base in concentrated from and see "SEARCH THIS CLASS, SUBCLASS" and "SEARCH CLASS" thereunder for related fields of search.

159, Concentrating Evaporators, subclasses 47.1+ for a process of concentrating a liquid, and see "SEARCH CLASS" thereunder for related fields of search.

208, Mineral Oils: Processes and Products, subclass 347 for a process of distilling mineral oil not otherwise provided for.

264, Plastic and Nonmetallic Article Shaping or Treating: Processes, subclasses 405+ for a process directed to applying electrical or wave energy directly to the work.

426, Food or Edible Material: Processes, Compositions, and Products, appropriate subclasses for a process of preparing a beverage base in concentrated form.

CROSS-REFERENCE ART COLLECTIONS

The following subclass represents at least a substantial collection of patents found elsewhere in the classification of this class which merit isolation for search aid purposes on specific types of heating.

100 PARTICULAR TYPE OF HEATING:

This subclass is indented under the class definition. Processes as provided for in this class wherein there is recited or disclosed a reference to a special type of heating, such as separation of the vapor by the heating effect of sonic waves of a specific frequency.

SEE OR SEARCH CLASS:

95, Gas Separation: Processes, subclasses 29+ for processes of gas separation in which the separation is effected or enhanced by use of sound waves.

165, Heat Exchange, appropriate subclasses for apparatus and processes for the transfer of heat from one material to another and see "SEARCH CLASS" under the class definition for related fields of search.

196, Mineral Oils: Apparatus, subclasses 120+ for mineral oil vaporizing apparatus having special means for heating.

202, Distillation: Apparatus, subclass 234 for distillation apparatus using radiant heat or electric heating elements.

210, Liquid Purification or Separation, subclass 738 for a process of separating liquid mixtures using pulsations or oscillations.

432, Heating, subclasses 1+ for a process of heating or heater, operation not elsewhere provided for.

END