

**CLASS 208, MINERAL OILS: PROCESSES AND PRODUCTS****SECTION I - CLASS DEFINITION**

This class includes:

Processes for the recovery or treatment of natural occurring mineral oil which result in the production of a purified or modified mineral oil or of coke.

Mineral oil products of the above processes or mixtures thereof which include only mineral oil components.

Processes for the recovery of oily liquid or tar-like hydrocarbonaceous material from a solid mineral source.

**APPARATUS**

See References to Other Classes, below, that reference apparatus

**SECTION II - LINES WITH OTHER CLASSES AND WITHIN THIS CLASS****PROCESSES OF TREATING MINERAL OIL**

Processes that treat a mineral oil to produce both a particular carbon compound classified in Class 260, Class 518, Class 560, Class 562, or Class 568 and a mineral oil classified in Class 208 are classified in Class 208.

See References to Other Classes, below, that reference processes of treating mineral oil.

**PRODUCTS AND COMPOSITIONS**

The products and compositions classified in this class (208) are those which consist only of a mineral oil or mixtures of mineral oils. Compositions including, in addition to a mineral oil, some nonmineral oil component are classified in other composition classes, usually upon the basis of the use, property or function of the composition. Class 508, Solid Antifriction Devices, Materials Therefor, Lubricant or Separant Compositions for Moving Solid Surfaces, and Miscellaneous Mineral Oil Compositions, is the residual class for heavy mineral oil compositions not otherwise provided for.

The rules for determining Class placement of the Original Reference (OR) for claimed chemical compositions are set forth in the Class Definition of Class 252 in the

section LINES WITH OTHER CLASSES AND WITHIN THIS CLASS, subsection COMPOSITION CLASS SUPERIORITY, which includes a hierarchical ORDER OF SUPERIORITY FOR COMPOSITION CLASSES.

**SECTION III - REFERENCES TO OTHER CLASSES****SEE OR SEARCH CLASS:**

- 34, Drying and Gas or Vapor Contact With Solids, subclass 428 for a process of cooling solids by mere contact with a gas; that is, quenching, per se, of a solid by use of a gas. (Processes of treating mineral oil).
- 34, Drying and Gas or Vapor Contact With Solids, appropriate subclasses, and particularly subclasses 443+ for miscellaneous methods of contacting solids with gases or vapors.
- 48, Gas: Heating and Illuminating, appropriate subclass, for processes of producing a heating or illuminating gas from mineral oil wherein no liquid mineral oil is recovered. Processes which result in the production of both a modified mineral oil and a gas are classified in this class (208) see also the reference of Class 48 in the definitions of subclass 400, below. (Processes of treating mineral oil).
- 62, Refrigeration, subclass 64 quenching, per se, of a solid article by use of a liquid. (Processes of treating mineral oil).
- 75, Specialized Metallurgical Processes, Compositions for Use Therein, Consolidated Metal Powder Compositions, and Loose Metal Particulate Mixtures, for a process in which metal (usually considered a catalyst poison) is recovered in elemental form from a hydrocarbonaceous material which has come out of the ground. Where a patent has a Class 75 claim and a Class 208 claim, it is classified in Class 75 and cross-referenced in this class (208).
- 95, Gas Separation: Processes, for processes of separation of mineral oil from gases; see the notes in subclass 340 of Class 208 for the line between these classes. (Processes of treating mineral oil).
- 96, Gas Separation: Apparatus, for apparatus for gas separation. (apparatus).
- 122, Liquid Heaters and Vaporizers, for liquid heaters, including those disclosed for merely heating mineral oil. (apparatus).

- 165, Heat Exchange, appropriate subclasses for a heat exchanger not specialized to the mineral oil art. (apparatus).
- 166, Wells, subclasses 244.1+ for processes of treating mineral oils involving the use of wells, especially subclasses 256+ for processes involving in situ combination, subclass 266 for a process involving treating oil after it has left a producing well and placing a separated constituent of the oil into an injection well, subclasses 272.1+ for processes using injection and producing wells and heating the formation and subclasses 302+ for miscellaneous processes involving heating. (Processes of treating mineral oil).
- 196, Mineral Oils: Apparatus, appropriate subclasses for apparatus for carrying out processes classifiable in Class 208 and not elsewhere classified. (apparatus).
- 202, Distillation: Apparatus, subclasses 81+ for distillation apparatus excluding that disclosed solely for distilling mineral oil. (apparatus).
- 204, Chemistry: Electrical and Wave Energy, subclasses 193+ for electrolytic apparatus and apparatus for treating materials to cause a chemical reaction (other than by mere heating). (apparatus).
- 204, Chemistry: Electrical and Wave Energy, appropriate subclass, for the treatment of mineral oil involving the use of electrical or wave energy, other than mere electrical heating. (Processes of treating mineral oil).
- 210, Liquid Purification or Separation, appropriate subclasses, particularly subclass 767 for processes of separating or purifying mineral oil by filtering or liquid settling or decanting. Purification of mineral oil by treating with sorptive agents or an agent which exerts some chemical or solvent action is classified in this class (208). The line between Class 210 and Class 208 with respect to treatment with a solvent chemical or sorbent treating agent is as follows: Where the disclosure includes both water and a mineral oil, the patent is classified in: (1) Class 210 if all claims are broad as to the liquid treated. (2) Class 210 if any claim is limited to the treatment of water (whether or not there are other claims limited to the treatment of other liquids). (3) Class 208 if the only claimed species of liquid treated is mineral oil. Where water is the only disclosed liquid treated the patent will be classified in Class 210. If mineral oil is the only disclosed liquid treated the patent is classified in Class 208.
- 210, Liquid Purification or Separation, appropriate subclasses for apparatus for separating or purifying a liquid within the scope of the definition thereof even though mineral oil is disclosed as the liquid treated, including apparatus for treating mineral oil with sorbive agents, but excluding apparatus for refining mineral oil with chemical agents. (apparatus).
- 252, Compositions, particularly subclasses 182.11+, for chemical agents, per se.
- 261, Gas and Liquid Contact Apparatus, appropriate subclasses for gas scrubbing devices (e.g., bubble towers). (apparatus).
- 299, Mining or In Situ Disintegration of Hard Material, appropriate subclass for mining mineral oil and oil bearing earth. (Processes of treating mineral oil).
- 406, Conveyors: Fluid Current, appropriate subclasses for solids transferring methods and apparatus.
- 422, Chemical Apparatus and Process Disinfecting, Deodorizing, Preserving, or Sterilizing, subclasses 631 through 638 and 211+ for apparatus for treating a material (including mineral oil) with a catalyst (apparatus).
- 423, Chemistry of Inorganic Compounds, subclasses 210+ for purifying or separating gaseous mixtures by a chemical reaction, and other appropriate subclasses for the recovery of an inorganic compound or nonmetallic element from a hydrocarbonaceous material which has come out of the ground. Where a patent has a Class 423 claim, and a Class 208 claim, it is classified in Class 423 and cross-referenced to this class (208). (Processes of treating mineral oil).
- 435, Chemistry: Molecular Biology and Microbiology, subclass 281 for processes of treating or separating mineral oil including a fermenting operation. (Processes of treating mineral oil).
- 435, Chemistry: Molecular Biology and Microbiology, appropriate subclasses for apparatus for carrying out fermentation. (apparatus).
- 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. (apparatus).
- 494, Imperforate Bowl: Centrifugal Separators, subclass 37 for a 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. (Processes of treating mineral oil).
- 502, Catalyst, Solid Sorbent, or Support Thereof: Product or Process of Making, for a catalyst or sorbent which may be used in a process of this class (208) and a method of making or regenerating such composition.
- 516, Colloid Systems and Wetting Agents; Subcombinations Thereof; Processes of Making, Stabilizing, Breaking, or Inhibiting, subclasses 113+ for compositions for or subcombination compositions for or breaking of or inhibiting of colloid systems (e.g., foam breaking, emulsion breaking, dispersion inhibiting, suspension settling, gel breaking, smoke suppressing, coagulating, flocculating), when generically claimed or when there is no hierarchically superior provision in the USPC for the specifically claimed art, and when there is no additional treatment of the oil. Combinations of emulsion breaking and a treatment of the mineral oil provided for in Class 208 are classified in Class 208.
- 518, Chemistry: Fischer-Tropsch Processes; or Purification or Recovery of Products Thereof, for processes of producing hydrocarbons by the hydrogenation of carbon oxides. (Processes of treating mineral oil).
- 560, Organic Compounds, subclass 241.1 for processes of oxidizing nonaromatic hydrocarbon mixtures. (Processes of treating mineral oil).
- 562, Organic Compounds, subclasses 512.2 and 512.4 for processes of oxidizing nonaromatic hydrocarbon mixtures. (Processes of treating mineral oil).
- 568, Organic Compounds, subclasses 398.8, 469.9, 910.5, and 949-959 for processes of oxidizing nonaromatic hydrocarbon mixtures. (Processes of treating mineral oil).
- 585, Chemistry of Hydrocarbon Compounds, for hydrocarbon compounds, certain compositions containing nonmineral oil hydrocarbons and processes for synthesizing or purifying such materials. See the Class Definition of that class, Lines With Other Classes, for statements of the line between Class 585 and Class 208. (Processes of treating mineral oil).
- 588, Hazardous or Toxic Waste Destruction or Containment, subclasses 313 through 321 and 405-415 wherein mineral are the hazardous or toxic waste being destroyed or contained. (Processes of treating mineral oil).
- ASPHALT**
- A brown to black solid bituminous substance either occurring naturally or obtained as a residue from certain petroleums, coal tars, lignite tar, etc.
- COAL TAR**
- Mixture of aromatic hydrocarbons obtained by the distillation of bituminous coal.
- COKING**
- A cracking type conversion in which solid, free carbon or coke as a product thereof. Additional liquid or gaseous hydrocarbon may also be obtained.
- CONVERSION**
- A treatment of the mineral oil which results in an alteration of the hydrocarbon molecule making up the mineral oil.
- CRACKING**
- A conversion treatment in which the hydrocarbons of the mineral oil are broken down to a shorter carbon chain length, resulting in hydrocarbons having a lower boiling temperature, which may be carried out in the presence of a catalyst (catalytic cracking) or in the absence of any catalyst (thermal cracking).
- FEED**
- The mineral oil which is subjected to treating processes provided for in this class, which in most cases, is a mixture of hydrocarbons.
- FRACTIONATION**
- The separation of one portion of the hydrocarbons of a mineral oil from another, regardless of the steps employed for affecting such separation. The separated fractions usually differ from each other in some chemical or physical property as for instance in boiling range (in the case of distillation) or solubility in a solvent (as in extraction).
- MINERAL OIL**
- Included in this term are natural petroleum, asphalt, tars, pitches and waxes which are primarily mixtures of hydrocarbons. Included also are Fischer-Tropsch crudes,

**SECTION IV - GLOSSARY**

that is, the liquid hydrocarbonaceous mixture resulting from the hydrogenation of a carbon oxide, wood tars and wood tar oils which are similar to coal tar in that they include an unidentified mixture, including hydrocarbons. Solid carbonaceous materials such as coal, lignite, peat, etc., (as distinguished from solid asphalts or asphalt bearing shales or sands) are not included.

#### PERIODIC TABLE

In this class metals and metal compounds may be identified as belonging to a certain "Group" distinguished by Roman numerals. These groups are taken from Henry D. Hubbard's "Periodic chart of the Atoms" (1956 Ed.).

- (1) Note. The metals making up the various groups are as follows:

IA = Li, Na, K, Rb, Cs and Fr (these metals are also identified as "alkali metals").

IB = Cu, Ag and Au

IIA = Be, Mg, Ca, Sr, Ba and Ra (Mg, Ca, Sr and Ba are also identified as "alkaline earth metals")

IIB = Zn, Cd and Hg

III = Al, Ga, In, Tl, Sc, Y, Rare Earth metals and Actinide series metals [Rare Earth Metals: La, Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb and Lu; Actinide Series Metals (atomic numbers 89 and greater) Ac, Th, Pa, U, Np, Pu, Am, Cm, Bk, Cf, E, Fm and Mv]

IV = Ge, Sn, Pb, Ti, Zr and Hf

V = As, Sb, Bi, V, Nb and Ta

VI = Po, Cr, Mo and W

VII = Mn, Tc and Re

VIII = Fe, Co, Ni, Ru, Rh, Pd, Os, Ir and Pt. (Ru, Rh, Pd, Os, Ir and Pt are also known as "Noble Metals")

#### REFINING

The removal of impurities or nonhydrocarbon, gums or gum forming components from a mineral oil or the conversion of such components to some less objectionable

form (e.g., sweetening: conversion of mercaptans to disulfides).

#### REFORMING

A chemical conversion operation which results in a change of the hydrocarbon molecule such that the product has substantially the same boiling range but has its "antiknock" or "octane" rating improved or increased. Various types of reaction are believed to be involved including cyclization, hydrogenation, dehydrogenation, alkylation, isomerization and dealkylation. Such reactions, if applied to a mineral oil, are classified in the subclass providing for reforming.

#### SUBCLASSES

##### 1 SYNTHETIC DRYING OILS:

This subclass is indented under the class definition. Mineral oil products and compositions which have the properties of and simulate natural drying oil in that they dry or harden in contact with the air and processes of preparing the same.

- (1) Note. The mineral oil products classified herein must be claimed or disclosed as having drying properties.

SEE OR SEARCH THIS CLASS, SUBCLASS:

14+, for nondrying mineral oil products and admixtures.

SEE OR SEARCH CLASS:

106, Compositions: Coating or Plastic, appropriate subclasses and particularly subclass 285 for coating or plastic compositions comprising a mineral oil which has drying properties and nonmineral oil components.

520, Synthetic Resins or Natural Rubbers, for compositions comprising a mineral oil having drying properties and a synthetic resin or natural rubber.

585, Chemistry of Hydrocarbon Compounds, appropriate subclasses, especially subclasses 429 and 507+, for the synthesis of nonmineral drying oil; and subclass 945 for a collection of patents which disclose products having utility as drying oil.

**2 PHENOLIC OR TOXIC OILS:**  
This subclass is indented under the class definition. Mineral oil products and compositions which are phenolic in character or have properties of killing, repelling or preventing the growth of insects, fungi or bacteria, and the processes of preparation thereof.

- (1) Note. This subclass also includes wood tars, wood tar oils, and derivatives thereof which are phenolic or exhibit toxic properties similar to coal tar, etc.

SEE OR SEARCH THIS CLASS, SUBCLASS:

14+, for mineral oil products and admixtures of mineral oils.

SEE OR SEARCH CLASS:

201, Distillation: Processes, Thermolytic, appropriate subclasses, for a process of carbonizing wood and recovering wood tar oil.

424, Drug, Bio-Affecting and Body Treating Compositions, for a toxic oil of this class (208) with some other ingredient, e.g., active, carrier, diluent, etc., and see subclasses 346+ for a phenolic composition.

514, Drug, Bio-Affecting and Body Treating Compositions, subclass 939 for a mineral oil emulsion.

588, Hazardous or Toxic Waste Destruction or Containment, subclasses 313 through 321, 405-415 and 249-260 for the destruction or containment of phenolic or toxic oil waste.

**3 OXIDATION OF MINERAL OILS:**  
This subclass is indented under the class definition. Processes of preparation of a mineral oil which include an oxidizing treatment to convert a part of the hydrocarbons into oxygenated hydrocarbons resulting in the production of a mixture thereof with hydrocarbons, and the products of such processes.

SEE OR SEARCH CLASS:

554, Organic Compounds, subclass 132 and indented subclasses for processes of oxidizing nonaromatic paraffin mixtures to form mixtures of organic compounds.

560, Organic Compounds, subclass 241.1 for process of oxidizing nonaromatic paraffin mixtures to form mixtures of organic compounds.

562, Organic Compounds, subclasses 512.2 and 512.4 for processes of oxidizing nonaromatic paraffin mixtures to form mixtures of organic compounds.

568, Organic Compounds, subclasses 398.8, 469.9, 910.5, and 949-959 for processes of oxidizing nonaromatic paraffin mixtures to form mixtures of organic compounds.

**4 To form asphalts, tars or pitches:**

This subclass is indented under subclass 3. Processes for producing asphalts, tars or pitches by oxidation of mineral oils and products of such processes.

**5 In presence of solid contact material:**

This subclass is indented under subclass 4. Processes wherein the oxidation is carried out in the presence of a solid contact material, e.g., a catalyst.

**6 Tar, pitch, or asphalt feed:**

This subclass is indented under subclass 4. Processes wherein the material subjected to the oxidizing treatment is itself an asphalt, tar or pitch.

- (1) Note. The processes classified herein involve the modification of the general properties of the asphalt, pitch or tar, e.g., raise the melting point thereof.

SEE OR SEARCH THIS CLASS, SUBCLASS:

128, and 130, for processes of converting mineral oils in the presence of air or steam respectively involving no oxidation of the oil.

SEE OR SEARCH CLASS:

106, Compositions: Coating or Plastic, appropriate subclasses, and particularly subclasses 273.1+ for coating or plastic compositions containing oxidized asphalts, tars or pitches and a nonmineral oil additive.

7

**With cracking:**

This subclass is indented under subclass 3. Processes which include a mineral oil cracking step in addition to the oxidation treatment.

- (1) Note. This subclass contains, for example, processes of cracking mineral oils wherein air or oxidizing gas is introduced into the cracking zone during cracking to exercise some oxidizing of the mineral oil.

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

106+, for mineral oil cracking processes, per se, particularly subclasses 128+ for cracking mineral oil in the presence of nonreactive gases or vapors. See the definition to subclass 106 for the definition and scope of the term "cracking".

**SEE OR SEARCH CLASS:**

554, Organic Compounds, subclass 132 and indented subclasses for the oxidation of petroleum or other nonaromatic hydrocarbon mixtures to obtain definite organic compounds of mixtures thereof.

12

**COLORING TREATMENTS (INCLUDES FLUORESCENCE):**

This subclass is indented under the class definition. Processes of imparting a desired color property to mineral oils and products of such processes.

- (1) Note. The processes classified herein involve a treatment of the oil to give the desired color property which is more than the mere addition of a color body thereto. However, some of the patents classified herein recite the treatment of the oil with another mineral oil which may impart bloom or fluorescence to the oil being treated. Treatments with nonmineral oil color bodies (pigments or dyes) are classified in the appropriate composition class.

**SEE OR SEARCH CLASS:**

- 8, Bleaching and Dyeing; Fluid Treatment and Chemical Modification of Textiles and Fibers, subclass for process and 521 compositions for dyeing oils or waxes.
- 106, Compositions: Coating or Plastic, subclass 272 for wax with a nonmineral oil dye or pigment and subclasses 280-284 for bituminous compositions containing nonmineral oil dye or pigment.

13

**TREATMENT OF REFINING SLUDGE:**

This subclass is indented under the class definition. Processes which include the treatment of a sludge obtained in the refining of mineral oils to recover additional mineral oil values therefrom.

- (1) Note. This subclass contains, for example patents dealing with the treatment of the sludges obtained as a result of the sulfuric acid or aluminum chloride refining of mineral oils.
- (2) Note. When the recovery of the inorganic compound (e.g., sulfuric acid) is specifically claimed the patent will be classified in Classes 23, Chemistry: Physical Processes and 423, Chemistry of Inorganic Compounds, whether or not mineral oil is also recovered. Processes wherein an organic compound such as an organic sulfonic acid or sulfonate is recovered in addition to a mineral oil are classified in this subclass and cross referenced to Class 260, Chemistry of Carbon Compounds, when desirable. Class 260 provides for such organic compound recovery processes when no mineral oil is recovered.

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

266+, for the sulfuric acid refining of mineral oils.

**SEE OR SEARCH CLASS:**

423, Chemistry of Inorganic Compounds, subclasses 522+ for the manufacture of sulfuric acid by a chemical reaction.

- 585, Chemistry of Hydrocarbon Compounds, subclasses 240+ for the production of a hydrocarbon mixture from nonmineral oil "waste" products.
- 588, Hazardous or Toxic Waste Destruction or Containment, subclasses 313 through 321 and 405-415 for the destruction of hazardous or toxic waste refining sludge.

#### 14 PRODUCTS AND COMPOSITIONS:

This subclass is indented under the class definition. Products and compositions which include only mineral oils or mixtures of two or more mineral oils or mineral oil fractions, and processes of preparation of such mixtures which include only a mixing or blending of the mineral oils with each other.

- (1) Note. Mixtures of mineral oils with a nonmineral oil material are not included in this or indented subclasses but are classified elsewhere, usually on the basis of the use, property or function of the composition. See (1) Note in the class definition of this class (208).
- (2) Note. Processes of preparation of mineral oil compositions which involve a chemical conversion of the hydrocarbon, a refining treatment or fractionation step, whether or not combined with a mixing or blending step, are classified in the subclass providing for the particular treatments involved.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 1, for mineral oil products and compositions which exhibit drying properties.
- 3+, for products of oxidation of mineral oils.

SEE OR SEARCH CLASS:

- 44, Fuel and Related Compositions, appropriate subclasses, especially subclasses 591 and 607 for a fuel product containing a carbonized component and subclass 599 for a method of making a consolidated fuel product which includes carbonizing using a specified condition or technique.

- 423, Chemistry of Inorganic Compounds, subclasses 445+ for elemental carbon.
- 508, Solid Anti-Friction Devices, Materials Therefor, Lubricant or Separant Compositions for Moving Solid Surfaces, and Miscellaneous Mineral Oil Compositions, for mineral oil lubricants with nonhydrocarbon or solid polymeric hydrocarbon material added thereto and for miscellaneous heavy mineral oil compositions with nonhydrocarbon or solid polymeric hydrocarbon material added thereto. See (1) Note.
- 585, Chemistry of Hydrocarbon Compounds, subclasses 1+ for other hydrocarbon compositions.

#### 15 Fuels:

This subclass is indented under subclass 14. Products and compositions which are claimed or disclosed for use as fuels.

- (1) Note. Many of the patents in this subclass are directed to fuels for supplying heat or to be used in Diesel engines.

SEE OR SEARCH CLASS:

- 44, Fuel and Related Compositions, appropriate subclasses, for fuel compositions which contain nonhydrocarbon additive.
- 149, Explosive and Thermic Compositions or Charges, for fuels disclosed for use in jet or rocket engines and which comprise a mineral oil and a nonmineral oil material. A mixture of mineral oils only which is a jet fuel is still classified in this class (208).
- 585, Chemistry of Hydrocarbon Compounds, subclasses 1+, especially subclass 14 for a fuel comprising a mineral oil component with a nonmineral oil hydrocarbon component. Those processes of preparing fuel oils which involve a chemical conversion of the mineral oil and subsequent treatment of a known hydrocarbon component, separated therefrom or formed in the process, which may be rebled with the mineral oil components are classified in this class (208) in the subclass providing therefor (see (2) Note to the definition of subclass 14).

**16 Gasolines:**

This subclass is indented under subclass 15. Products and compositions which are claimed disclosed for use as fuels for internal combustion engines and which generally have a boiling range of below 400 to 425°.

**17 Admixtures:**

This subclass is indented under subclass 16. Products and compositions which are blends or mixtures of two or more mineral oils or mineral oil fraction and methods of mixing or blending them.

- (1) Note. Products classified herein may be a blend or mixture of two or more gasoline fractions or a mixture of a gasoline with another mineral oil fraction (not a gasoline). Providing the product has a boiling range within the limits set out in the definition of subclass 16.

**SEE OR SEARCH CLASS:**

- 44, Fuel and Related Compositions, subclasses 300+ for fuel oil compositions containing nonhydrocarbon additives.
- 585, Chemistry of Hydrocarbon Compounds, subclasses 1+, especially subclass 14 for a composition comprising gasoline and a definite hydrocarbon which is not a mineral oil.

**18 Lubricating oils:**

This subclass is indented under subclass 14. Products and compositions which are claimed or disclosed for use as lubricants between relatively moving surfaces, and which are liquid at normal atmospheric temperatures (lubricating oils).

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

- 20+, for solid lubricants including paraffin wax.

**19 Admixtures:**

This subclass is indented under subclass 18. Products and compositions which are blends or mixtures of two or more mineral oils or mineral oil fractions and methods of mixing such oils.

- (1) Note. Mixtures or blends classified in this subclass may include a wax or asphaltic component if the mixture is liquid at normal atmospheric temperatures.

**SEE OR SEARCH CLASS:**

- 508, Solid Anti-Friction Devices, Materials Therefor, Lubricant or Separant Compositions for Moving Solid Surfaces, and Miscellaneous Mineral Oil Compositions, particularly subclasses 110+ for lubricants containing nonhydrocarbon or solid polymeric hydrocarbon additives. Subclass 110+ is the residual place for compositions of heavy mineral oils admixed with nonhydrocarbon or solid polymeric hydrocarbon ingredients not disclosed as lubricants nor provided for elsewhere.
- 585, Chemistry of Hydrocarbon Compounds, subclasses 1+ for a lubricating composition containing a definite hydrocarbon, in particular, subclasses 9 and 13 for a lubricant blended from a mineral oil fraction and a nonmineral oil hydrocarbon.

**20 Waxes:**

This subclass is indented under subclass 14. Products and compositions which include paraffin wax.

- (1) Note. Paraffin wax consists of a colorless, odorless, tasteless mixture of solid hydrocarbons of the paraffin series and is slightly greasy to the touch.

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

- 24+, for processes of treating, refining or recovering paraffin wax.

**SEE OR SEARCH CLASS:**

- 585, Chemistry of Hydrocarbon Compounds, subclass 9 for an all hydrocarbon composition containing mineral wax plus a nonmineral oil hydrocarbon or a synthetically produced wax; and subclass 946 for a collection of patents drawn to the production of a greasy or waxy nonresinous hydrocarbon polymer.

**21 Admixtures:**

This subclass is indented under subclass 20. Products and compositions which are blends or mixtures of petroleum waxes or of a wax and a mineral oil, and methods of mixing such ingredients.

**SEE OR SEARCH CLASS:**

- 106, Compositions: Coating or Plastic, particularly subclasses 270+ for compositions containing mixtures of petroleum waxes and nonmineral oil material.
- 520, Synthetic Resins or Natural Rubbers, particularly Class 524, subclasses 487+ and 848 for mixtures of petroleum waxes with synthetic resins or natural rubbers.

**22 Asphalts, tars, pitches and resins:**

This subclass is indented under subclass 14. Products and compositions which include asphalts, tars, pitches or resins derived from petroleum, coal tar, or petroleum tar sources, or from solid natural sources such as asphaltic rocks or bituminous sands.

- (1) Note. Asphalts, tars, pitches and resins are relatively high boiling, viscous or solid dark colored fractions or residues which may result from petroleum distillation or treatment or which may be natural occurring. Resins classified herein are those derived from mineral oils, such as asphalts by solvent extraction or which are residues of mineral oil treating processes.

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

- 4+, for the production of asphalt, tar or pitch by oxidation of a mineral oil material.
- 39+, for processes of preparing, recovering or treating asphalts, tars, pitches or resins.

**SEE OR SEARCH CLASS:**

- 260, Chemistry of Carbon Compounds, and particularly Class 526 thereunder and, subclass 290 for synthetic resins formed from an unsaturated petroleum hydrocarbon fraction.

- 520, Synthetic Resins or Natural Rubbers-- Part of the Class 520 Series, subclass 1 for synthetic resins or natural rubbers preparation, or treatment thereof; compositions containing synthetic resins or natural rubbers preparation or treatment thereof.

**23 Admixtures:**

This subclass is indented under subclass 22. Products and compositions which are mixtures of a natural asphalt, petroleum asphalt, tar, pitch, or resin with each other or with some other mineral oil, and methods of mixing such ingredients.

**SEE OR SEARCH CLASS:**

- 106, Compositions: Coating or Plastic, particularly subclasses 273.1+ for compositions containing mixtures of asphalt, tar, pitch or petroleum resin and a nonmineral oil material.

**24 PARAFFIN WAX; TREATMENT OR RECOVERY:**

This subclass is indented under the class definition. Processes for the treatment, preparation, separation or purification of paraffin waxes wherein the product retain its identity as a wax.

- (1) Note. Paraffin waxes are the colorless mixtures of solid hydrocarbons of the paraffin series. Petrolatum which is composed of a mixture of heavy residual oils and paraffin wax is considered a paraffin wax.

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

- 46+, for the conversion of paraffin wax to another mineral oil nonwax product.

**SEE OR SEARCH CLASS:**

- 196, Mineral Oils: Apparatus, subclass 14.5 for apparatus for separating paraffin wax from a nonwaxy mineral oil.
- 210, Liquid Purification or Separation, appropriate subclass for apparatus for purifying paraffin waxes by filtration, decantation or dialysis, not combined with a treatment of the wax provided for in this class (208).

- 422, Chemical Apparatus and Process Disinfecting, Deodorizing, Preserving, or Sterilizing, appropriate subclasses for apparatus for treating paraffin waxes with chemicals.
- 25 With ureas:**  
This subclass is indented under subclass 24. Processes wherein a urea is employed as a treating agent.
- (1) Note. Included herein are those processes in which urea is used to separate paraffin wax from wax containing mixtures by forming an adduct with the wax which then is separated from the other material.
- SEE OR SEARCH CLASS:  
564, Organic Compounds, subclass 1.5 for adducts of ureas and an organic compound and processes for their preparation as well as processes of separating or purifying organic compounds by forming adducts thereof with ureas.
- 26 With sorption agents:**  
This subclass is indented under subclass 24. Processes including treatment with a solid contact material, e.g., a catalyst or an adsorbent.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
177+, and particularly subclasses 299+ for refining of mineral oils other than waxes by contact with solid contact materials.
- 27 Chemical treatment (refining or modification except mere solvent extraction):**  
This subclass is indented under subclass 24. Processes wherein the paraffin wax is treated with a material which exerts a chemical reaction on the wax or component associated therewith.
- (1) Note. Included in this subclass are processes of refining paraffin waxes and/or modifying their chemical and physical properties, by treatment with chemicals, excluding processes of mere solvent extraction.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
3, for processes of oxidizing of paraffin waxes.
- SEE OR SEARCH CLASS:  
554, Organic Compounds, subclasses 124+ and 175+ for similar treatments of vegetable waxes.  
570, Organic Compounds, for processes of halogenating paraffin wax.
- 28 Separation of paraffin from oil (e.g., dewaxing):**  
This subclass is indented under subclass 24. Processes for the separation of paraffin wax from another mineral oil associated therewith.
- (1) Note. The separation may be by mechanical means or by the addition of solvents or other materials to the mixture and the oil may be recovered separately.
- (2) Note. Processes for the removal of paraffin wax from a liquid mineral oil is generally known as "dewaxing" (of the mineral oil) and the separation of the residual oil associated with a solid paraffin wax is generally known as "deoiling".
- SEE OR SEARCH CLASS:  
62, Refrigeration, appropriate subclasses, for refrigerating processes and apparatus.  
100, Presses, appropriate subclasses for presses not provided for elsewhere, particularly subclasses 104+ for presses having a drain duct or channel for liquid expressed from the material pressed.  
196, Mineral Oils: Apparatus, subclass 14.5 for dewaxing apparatus.  
210, Liquid Purification or Separation, appropriate subclasses, especially subclasses 175+, 737, 766, and 774+ for liquid separating processes and apparatus involving the use of heaters or coolers.  
494, Imperforate Bowl: Centrifugal Separators, appropriate subclasses, for a separator of that class, as explained in the references thereto appearing in

Sections 3 and 5 of the definition of this class (208).

29

**Emulsion dewaxing:**

This subclass is indented under subclass 28. Processes wherein the oil-paraffin separation involves the formation of an emulsion or dispersion.

## SEE OR SEARCH CLASS:

516, Colloid Systems and Wetting Agents; Subcombinations Thereof; Processes of Making, Stabilizing, Breaking, or Inhibiting, appropriate subclasses for subject matter relating to: colloid systems (such as sols\*, emulsions, dispersions, foams, aerosols, smokes, gels, or pastes) or wetting agents (such as leveling, penetrating, or spreading); subcombination compositions of colloid systems containing at least an agent specialized and designed for or peculiar to use in making or stabilizing colloid systems; compositions and subcombination compositions specialized and designed for or peculiar to use in breaking (resolving) or inhibiting colloid systems; processes of making the compositions or systems of the class; processes of breaking (resolving) or inhibiting colloid systems; in each instance, when generically claimed or when there is no hierarchically superior provision in the USPC for the specifically claimed art. Combinations of emulsion breaking and a treatment of the mineral oil provided for in Class 208 are classified in Class 208.

30

**Separation of residual oil from wax (i.e., deoiling):**

This subclass is indented under subclass 28. Processes for the separation of residual oil from paraffin wax.

- (1) Note. Treatments included in this and indented subclasses are those in which the material treated is primarily paraffin wax which includes a relatively small amount of oil, usually occluded or dissolved therein, and the treatments are for the purpose of purifying the paraffin wax by the removal of this residual oil.

- (2) Note. Processes of separating paraffin wax from a mineral oil (dewaxing) which include a broadly recited step of washing the wax to remove residual oil are classified on the basis of the dewaxing operation.

31

**With solvent:**

This subclass is indented under subclass 30. Processes wherein the separation is facilitated by the use of a nonreactive material which exerts a solvent action upon some component of the mixture.

## SEE OR SEARCH THIS CLASS, SUBCLASS:

33+, for processes of dewaxing mineral oils by use of solvents.

## SEE OR SEARCH CLASS:

210, Liquid Purification or Separation, appropriate subclass, for processes and apparatus for separating waxes from mineral oils by filtering.

32

**Sweating:**

This subclass is indented under subclass 30. Processes wherein paraffin wax containing residual oil is cooled and then slowly heated to release the lower melting point oils and other components.

33

**Solvent dewaxing:**

This subclass is indented under subclass 28. Processes wherein paraffin wax is separated or recovered by the use of a nonreactive material which exerts a solvent action upon some component of the mixture.

## SEE OR SEARCH THIS CLASS, SUBCLASS:

31, for deoiling processes wherein inert solvents are used.

## SEE OR SEARCH CLASS:

196, Mineral Oils: Apparatus, subclass 14.5 for dewaxing apparatus and subclass 14.52 for other solvent extraction apparatus disclosed for use on mineral oils.

**34 With deasphalting treatment:**

This subclass is indented under subclass 33. Processes combined with a step of separating asphalt.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 45, for solvent treatment of mineral oils to recover the asphalt therefrom as a product.
- 309, for treatments of mineral oils to remove asphalt therefrom which is regarded as an undesirable component thereof and no steps to recover or use the asphalt are included.

**35 With chilling by evaporation of solvent:**

This subclass is indented under subclass 33. Processes wherein the material is cooled or chilled by the evaporation of the solvent usually causing a precipitation of the separated paraffin wax.

- (1) Note. This subclass includes, for example, solvent dewaxing processes wherein the normally gaseous solvents which are used in liquid form are vaporized thereby causing a reduction in temperature and precipitation of paraffin wax.

**36 With nondewaxing solvent extraction of oil:**

This subclass is indented under subclass 33. Processes combined with a solvent extraction of mineral oil which extraction does not result in a separation of paraffin wax from the oil.

- (1) Note. The nondewaxing extraction may be prior to or subsequent to the wax separation by means of a solvent.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 311+, for solvent extraction of mineral oil to separate into a plurality of mineral oil fractions.

**37 Chilling:**

This subclass is indented under subclass 28. Processes including a step of lowering the temperature of the material treated, usually by refrigeration.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 33+, for processes of separating wax from a mineral oil by means of a solvent which include a chilling step.

SEE OR SEARCH CLASS:

- 62, Refrigeration, particularly subclasses 123+ for processes and apparatus for cooling or chilling paraffin wax-mineral oil mixtures by refrigeration, even though combined with a separation of solidified constituents (wax). Such processes combined with other treatments of the mixture or separated wax or oil, for example, solvent extraction, or distillation are classified in this class (208).
- 210, Liquid Purification or Separation, subclasses 175+, 737, 766, and 774+ for processes and apparatus for liquid separation combined with heating or cooling there provided for.

**38 With filtering:**

This subclass is indented under subclass 37. Processes including the separation of wax by use of a filtering medium.

SEE OR SEARCH CLASS:

- 210, Liquid Purification or Separation, appropriate subclasses for liquid filtering, per se.

**39 ASPHALTS, TARS, PITCHES AND RESINS; MAKING, TREATING AND RECOVERY:**

This subclass is indented under the class definition. Processes for preparing, separating, recovering or treating asphalts, tars, pitches and resins of mineral origin wherein the asphalt tar, resin, etc., is recovered as a product.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 4+, for oxidation of mineral oils to form asphalts as well as the oxidation of asphalts, tars, pitches, or resins, per se.
- 34, for the separation of asphalt from an oil in combination with the separation of paraffin wax from another mineral oil.

309, for treatments of mineral oils to remove asphalt therefrom which is regarded as an undesirable component thereof and no steps to recover or use the asphalt are included.

**SEE OR SEARCH CLASS:**

516, Colloid Systems and Wetting Agents; Subcombinations Thereof; Processes of Making, Stabilizing, Breaking, or Inhibiting, subclasses 113+ for compositions for or subcombination compositions for or breaking of or inhibiting of colloid systems (e.g., foam breaking, emulsion breaking, dispersion inhibiting, suspension settling, gel breaking, smoke suppressing, coagulating, flocculating), when generically claimed or when there is no hierarchically superior provision in the USPC for the specifically claimed art. Combinations of emulsion breaking and a treatment of the mineral oil provided for in Class 208 are classified in Class 208.

**40 By chemical conversion of oil:**

This subclass is indented under subclass 39. Processes wherein asphalt, tar, pitch or resin is produced by a chemical conversion of another liquid mineral oil.

(1) Note. Many processes classified herein include conversions of mineral oils wherein the residues of which are treated to recover asphaltic components therefrom.

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

4+, for oxidation of mineral oils to form asphalts tars or pitches.

44, for processes of chemically modifying an already formed asphalt, tar, pitch or resin.

**41 By distillation:**

This subclass is indented under subclass 39. Processes wherein asphalt, tar, pitch or resin is obtained by a distillation of an oil feed under nonconversion conditions.

**SEE OR SEARCH CLASS:**

201, Distillation: Processes, Thermolytic, appropriate subclasses, for a thermolytic distillation process producing tar, pitch or resin.

202, Distillation: Apparatus, appropriate subclass, for apparatus for distillation.

203, Distillation: Processes, Separatory, appropriate subclasses, for a process of distilling a liquid under nonconversion conditions.

**42 Tar feed:**

This subclass is indented under subclass 41. Processes wherein material distilled is a tar.

**43 By contact with hot gases:**

This subclass is indented under subclass 42. Processes wherein the tar is contacted by high temperature gas during distillation.

(1) Note. This subclass includes, for example, those processes of distilling tars wherein hot gases from another part of the process may be used to facilitate the distillation process.

**44 Chemical modification of asphalt, tar, pitch or resin:**

This subclass is indented under subclass 39. Processes including a chemical modification of an already formed asphalt, tar, pitch or resin.

(1) Note. Many of the processes classified herein result in a modification of the properties such as hardness, ductility, softening point, etc., of the asphalt, tar, pitch or resin treated.

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

4+, for oxidation of asphalts, tars, or pitches.

**45 Solvent extraction:**

This subclass is indented under subclass 39. Processes including a solvent extraction of the asphalt, tar, pitch, or resin.

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

309, for treatments of mineral oils to remove asphalt therefrom which is

regarded as an undesirable component thereof and no steps to recover or use the asphalt are included.

**46 CHEMICAL CONVERSION OF HYDRO-CARBONS:**

This subclass is indented under the class definition. Processes of treating mineral oils which result in a chemical alteration of at least some of the hydrocarbon molecules thereof forming mineral oils having different properties, or which result in the formation of coke.

- (1) Note. This and indented subclasses include chemical treatments of the mineral oil as cracking (forming shorter chain hydrocarbon, light fractions), hydrogenation (saturation of double bonds) polymerization (forming longer chain hydrocarbon molecules) reforming (isomerization of the hydrocarbon molecules, etc.) and decomposing at least a part of the oil to coke.
- (2) Note. Within this and indented subclasses 47 to 105 include combinations there provided for, whether the conversion is claimed broadly or specifically. Conversion processes which involve contacting mineral oil with a solid are classified in the subclass providing for the particular conversion when the mineral oil to be converted or the solid material (catalyst or inerts) is specifically identified. Such processes in which neither the oil to be converted or the solid material contacted therewith are specifically identified, even though the conversion be named, e.g., cracking, are included in subclass 146. Cross references of patents classified in other subclasses which disclose or claim any significant solids-oil contacting procedure are placed in subclass 146.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 27, for processes of treatment or recovery of paraffin wax including a mineral oil conversion.
- 40, for processes of making asphalt, tar, pitch or resins including a conversion of mineral oil.

- 44, for processes of chemical modification of asphalt tar, pitch or resin.

SEE OR SEARCH CLASS:

- 48, Gas: Heating and Illuminating, appropriate subclass for the conversion of a mineral oil to a gas; processes which result in the production of a mineral oil and a gas are classified in this class (208) unless the production of the mineral oil is only incidental to the process.
- 201, Distillation: Processes, Thermolytic, appropriate subclasses, for a process of thermolytic distillation of solid hydrocarbon containing material to produce coke, whether or not volatiles are recovered.
- 204, Chemistry: Electrical and Wave Energy, subclass 172 for electrostatic or electrical discharge cracking processes, other than those in which the chemical conversions are caused by merely thermal effects which are in this class (208).
- 422, Chemical Apparatus and Process Disinfecting, Deodorizing, Preserving, or Sterilizing, especially subclasses 631 through 638 and 211+ for apparatus for treating a material (including mineral oil) with a catalyst.
- 585, Chemistry of Hydrocarbon Compounds, appropriate subclasses for processes of forming definite identifiable carbon compounds from a mineral oil; however, the formation of a definite compound as an intermediate in a mineral oil treating process, such as a condensation process wherein a paraffin wax is chlorinated and subsequently dechlorinated or dehydrochlorinated to produce another mineral oil, is classified in this class (208).

**47 With prevention of corrosion or erosion in system:**

This subclass is indented under subclass 46. Processes including some step to prevent or reduce corrosion or erosion of the apparatus employed in the process.

- (1) Note. This subclass contains, for example, those processes involving introduction of agents that inhibit or prevent

corrosion or erosion as well as the removal of materials that tend to cause such corrosion or erosion during the conversion of the oil, when claimed in combination with conversion or conversion operations which are carried out in such manner as to avoid erosion or corrosion of the apparatus.

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

- 85+, for mineral oil conversion processes combined with preliminary treatments of the feed which do not reduce corrosion or erosion of the apparatus.
- 177+, for processes of removing nonhydrocarbons from mineral oils.
- 347+, and particularly subclass 348 for processes of preventing corrosion during a nonconversion distillation of a mineral oil.

**SEE OR SEARCH CLASS:**

- 106, Compositions: Coating or Plastic, subclass 14.05 for anti-corrosion coating compositions.
- 203, Distillation: Processes, Separatory, subclass 7, for a distillation process in which a substance is added to inhibit scale formation or to prevent corrosion.
- 252, Compositions, subclasses 387+ for anticorrosion compositions.
- 422, Chemical Apparatus and Process Disinfecting, Deodorizing, Preserving, or Sterilizing, subclasses 7+ for process of maintaining an environment nondestructive to metal.

**48 With prevention or removal of deleterious carbon accumulations or equipment:**

This subclass is indented under subclass 46. Processes which include (1) the prevention of the deposit or precipitation of solid carbon on the surfaces of the apparatus employed during a conversion of a mineral oil or (2) the removal of such solid deposits of carbon in combination with a conversion step.

- (1) Note. Processes classified herein are directed to the prevention of or removal of carbon deposits from the surfaces of the apparatus, such as would, for example, cause clogging of the pipes, and not

carbon which might deposit on the catalyst or inert solids employed in the process.

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

- 166+, particularly subclass 167 for processes involving solid-liquid contacting procedures. If it is disclosed that such procedures prevent deposition of carbon on the apparatus, the process is classified in this subclass (48) and cross referenced to the appropriate subclass providing for the manipulation.

**SEE OR SEARCH CLASS:**

- 122, Liquid Heaters and Vaporizers, subclasses 379+ for vaporizers having means to clean the same combined therewith.
- 134, Cleaning and Liquid Contact With Solids, for decarbonizing procedures, per se. Note particularly subclasses 8, 20 and 39.
- 196, Mineral Oils: Apparatus, subclass 122 for mineral oil vaporizers provided with means for removing carbon from the oil or the vaporizer.
- 201, Distillation: Processes, Thermolytic, subclass 2 for a process of thermolytic distillation including the step of cleaning the apparatus or removing adhering char product.
- 202, Distillation: Apparatus, subclass 241 for distillation apparatus with means to remove carbon.
- 203, Distillation: Processes, Separatory, subclass 7 for a distilling process in which material is added to the system to inhibit deposit formation.

**49 Plural serial stages of chemical conversion:**

This subclass is indented under subclass 46. Processes in which a mineral oil is subjected to two or more successive distinct chemical conversions.

- (1) Note. Processes classified herein include, for example, those in which the total product of the first conversion is subjected to a second conversion or those in which only a fraction of the

product of the first conversion is subjected to further conversion.

- (2) Note. Processes of treating a mineral oil to plural, successive conversions are included herein, even though one of the conversions is a reaction, per se, classifiable in Class 585, Chemistry of Hydrocarbon Compounds, etc., e.g., conversion of a mineral oil fraction to a definite compound (ethylene, butene, etc.), providing there is produced a converted mineral oil product. In such combination processes, including steps classifiable in Class 260, are classified in the subclass including the corresponding type of process (e.g., polymerization, hydrogenation, etc.). Combinations including dehydrogenation, isomerization, cyclization, aromatization, alkylation or dealkylation reactions are classified in the subclass providing for combinations including reforming.

SEE OR SEARCH THIS CLASS, SUBCLASS:

78+, for processes including plural distinct conversions applied to separate mineral oils or mineral oil fractions which are either (1) fractions from a single mineral oil source or (2) are subsequently blended or mixed.

SEE OR SEARCH CLASS:

260, Chemistry of Carbon Compounds, (see (2) Note).  
585, Chemistry of Hydrocarbon Compounds, etc. (see (2) Note).

- 50 Coking in at least one stage:**  
This subclass is indented under subclass 49. Processes wherein coke is a product of at least one of the conversion stages.

- (1) Note. Included herein are processes wherein, in at least one of the stages, mineral oils are converted to product coke, per se, or along with any hydrocarbons produced.

SEE OR SEARCH THIS CLASS, SUBCLASS:

106+, particularly subclasses 126 and 131 for single stage coking processes.

SEE OR SEARCH CLASS:

201, Distillation: Processes, Thermolytic, appropriate subclass, for a process of producing coke by distilling a non-mineral oil material and see subclass 23 for a process of producing coke by distilling a carbonaceous mixture including a minor amount of mineral oil.  
423, Chemistry of Inorganic Compounds, subclasses 449.1+ for manufacturing carbon by a chemical reaction.

**51 With reforming:**

This subclass is indented under subclass 50. Processes including also at least one distinct reforming operation.

SEE OR SEARCH THIS CLASS, SUBCLASS:

60, 62+ and 69+, for other plural conversions including reforming as at least one of the stages.

**52 With both catalytic and thermal cracking:**

This subclass is indented under subclass 50. Processes including also at least one stage of catalytic cracking and at least one stage of thermal cracking (not coke forming) in addition to the coke producing conversion step.

SEE OR SEARCH THIS CLASS, SUBCLASS:

72+, for processes in which a mineral oil is subjected only to successive stages of cracking.

**53 First stage is coking:**

This subclass is indented under subclass 50. Processes wherein the coke producing conversion occurs prior to any other conversion of the mineral oil.

**54 Second stage is cracking:**

This subclass is indented under subclass 53. Processes wherein the coke producing conversion is followed by a cracking operation in which no product coke is produced.

**55 Catalytic cracking:**

This subclass is indented under subclass 54. Processes wherein the cracking operation is promoted by the use of a catalytic material.

- 56 Hydrogen donor diluent cyclic processes:**  
This subclass is indented under subclass 49. Processes wherein one component or product of a conversion step is subjected to hydrogenation and then returned or recycled to the process as a source of hydrogen (a "hydrogen donor").
- 57 First stage is an hydrogenation (saturation):**  
This subclass is indented under subclass 49. Processes wherein mineral oil is subjected to hydrogenation treatment which saturates at least a part of the unsaturated hydrocarbons present prior to any other conversion step, and the hydrogenated material is not employed as a source of hydrogen in a subsequent conversion step.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
56, for cyclic hydrogen donor diluent processes.
- 58 First stage is hydrocracking (includes hydro-desulfurization under cracking conditions):**  
This subclass is indented under subclass 49. Processes wherein mineral oil is subjected to a cracking step in the presence of hydrogen prior to any other conversion step.
- (1) Note. For the purpose of classification in this and indented subclasses those plural stage conversions which include processes of desulfurizing mineral oils in the presence of hydrogen are classified herein if the hydrode sulfurization is carried out under conditions which cause cracking of the mineral oil.
- 59 Hydrocracking in all stages:**  
This subclass is indented under subclass 58. Processes wherein mineral oil is subjected only to a plurality of steps of destructive hydrogenation (cracking in the presence of hydrogen).
- 60 With subsequent reforming:**  
This subclass is indented under subclass 58. Processes including also at least one subsequent step of reforming.
- 61 With subsequent thermal or catalytic cracking:**  
This subclass is indented under subclass 58. Processes including also at least one subsequent step of thermal or catalytic cracking.
- 62 First stage is reforming:**  
This subclass is indented under subclass 49. Processes wherein the mineral oil is subjected to a reforming reaction prior to any other conversion step.
- 63 Reforming in all stages:**  
This subclass is indented under subclass 62. Processes wherein the mineral oil is subjected only to a plurality of steps of reforming.
- 64 Catalyst in at least one stage:**  
This subclass is indented under subclass 63. Processes wherein at least one of the reforming reactions takes place in the presence of catalytic material.
- 65 Noble metal containing catalyst:**  
This subclass is indented under subclass 64. Processes wherein the catalyst employed contains a noble metal of compound thereof. (Ru, Rh, Pd, Os, Ir or Pt).
- 66 Catalytic:**  
This subclass is indented under subclass 62. Processes wherein the reforming reaction takes place in the presence of catalytic material.
- 67 First stage is thermal or catalytic cracking:**  
This subclass is indented under subclass 49. Processes wherein the mineral oil is subjected to a thermal or a catalytic cracking reaction prior to any other conversion step.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
50+, for those plural serial stage conversion reactions including at least one step of cracking which results in the formation product coke.  
58+, for processes of subjecting a mineral oil to plural successive steps of conversion, the first of which is cracking in the presence of added hydrogen.

- 68 With subsequent hydrocracking:**  
This subclass is indented under subclass 67. Processes including at least one subsequent step of cracking in the presence of hydrogen (destructive hydrogenation).
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
58+, for processes which include plural serial conversions wherein the first stage is an hydrocracking reaction.
- 69 With subsequent reforming:**  
This subclass is indented under subclass 67. Processes including at least one subsequent step of reforming.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
51, for plural serial stage conversions wherein first stage cracking results in the production of product coke is followed by a reforming reaction.
- 70 Catalytic reforming:**  
This subclass is indented under subclass 69. Processes wherein the reforming reaction takes place in the present of catalytic material.
- 71 With subsequent polymerization:**  
This subclass is indented under subclass 67. Processes including at least one subsequent step of polymerization.
- 72 Cracking in all stages:**  
This subclass is indented under subclass 67. Processes wherein the mineral oil is subjected only to a plurality of stages of cracking reactions, either thermal or catalytic.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
52, and 53+, for processes wherein the oil is subjected to combinations of cracking reactions in series, at least one of which results in the production of product coke.
- 73 Catalyst in at least one stage:**  
This subclass is indented under subclass 72. Processes wherein at least one of the cracking steps takes place in the presence of catalytic material.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
52, and 55, for combinations of catalytic cracking operations which also include a coking step.
- 74 Catalyst in multiple stages:**  
This subclass is indented under subclass 73. Processes wherein at least two of the cracking steps take place in the presence of catalytic material.
- 75 With cracking of total product from first stage:**  
This subclass is indented under subclass 72. Processes wherein the total undivided product from the first cracking step is subjected to a subsequent cracking operation.
- 76 With cracking of the first stage bottoms:**  
This subclass is indented under subclass 72. Processes wherein the product of the initial cracking stage includes a plurality of separate fractions having different boiling ranges and in which the nonvolatilized or residual fraction is subjected to another cracking operation (all stages noncatalytic).
- 77 With cracking of the first stage intermediate fraction:**  
This subclass is indented under subclass 72. Processes wherein the product of the initial cracking stage includes a plurality of separate fractions having different boiling ranges, and includes at least one fraction intermediate the lowest boiling fraction and the nonvolatilized or residual fraction and at least one of said intermediate fractions is subjected to another cracking operation.
- 78 Plural parallel stages of chemical conversion:**  
This subclass is indented under subclass 46. Processes wherein a plurality of mineral oils or mineral oil fractions are separately subjected to conditions resulting in a conversion or alteration of the hydrocarbons.
- (1) Note. Processes classified in this or subclasses may involve subsequent blending of the products of the separate conversions, or the separate fractions may be from a single mineral oil source.

- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
49+, for processes wherein a mineral oil is subjected to a plurality of successive conversion operations.
- 79 At least one stage is reforming:**  
This subclass is indented under subclass 78. Processes wherein at least one of the conversion stages is a reforming reaction.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
62+, for processes including plural serial stage conversions wherein the first stage is a reforming reaction.
- 80 Split feed:**  
This subclass is indented under subclass 78. Processes wherein a single mineral oil is separated into a plurality of fractions at least two of which are subjected to conversion conditions.
- (1) Note. In many of the processes classified herein, the separately converted mineral oil products are blended to form the desired mineral oil admixture.
- 81 With contacting vapor products with liquid feed (i.e., product scrubbing and feed stripping):**  
This subclass is indented under subclass 46. Processes wherein a conversion operation is combined with the contactation of the mineral oil to be converted with a vapor product of the conversion operation prior to the conversion step (prior to entering the conversion zone) and in which the higher boiling components of the vapor product are absorbed by the mineral oil, and the more volatile products of the mineral oil feed are volatilized and stripped therefrom.
- (1) Note. The processes classified herein generally involve the stripping of the liquid feed with vapor products of the conversion stage prior to the feed entering the conversion zone. The liquid feed in turn scrubs the vapor products of undesirable products. The contacting must take place outside the actual conversion zone even if occurring in the same chamber. In any event, the contactation for mixing or fractionation purposes must precede the actual conversion step.
- 82 Only selected fractions of product or feed are contacted:**  
This subclass is indented under subclass 81. Processes wherein only a part of the vapor product or only a part of the mineral oil to be converted are contacted.
- (1) Note. The parts being contacted may be obtained by separation of the vapor product or mineral oil feed into fractions having different properties (e.g., boiling point).
- 83 With subsequent fractionation:**  
This subclass is indented under subclass 81. Processes wherein the products are separated into fraction having different properties subsequent to contacting the mineral oil feed.
- (1) Note. This separation is generally by distillation.
- 84 With added material (to scrubbing-stripping stage):**  
This subclass is indented under subclass 81. Processes wherein a material, other than the vapor product or mineral oil feed, is added to the vapor-oil contact zone.
- 85 With preliminary treatment of feed:**  
This subclass is indented under subclass 46. Processes wherein the mineral oil to be converted is subjected to some separate and distinct nonconversion treatment combined with a subsequent chemical conversion of the treated oil.
- (1) Note. Processes which include a single preliminary treatment defined by name only are not included in this or indented subclasses. Nor are processes included where the only "preliminary" treatment is heating the oil to conversion treatment (even though accompanied by vaporization of the oil) or the addition of the conversion catalyst or inerts, etc.
- 86 Deasphalting:**  
This subclass is indented under subclass 85. Processes wherein the mineral oil feed is subjected to a treatment to remove asphaltic com-

ponents therefrom prior to the conversion stage.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

39+, for the separation or recovery asphalt as a product.

308, for deasphalting treatments, per se.

**87 Solvent extraction:**

This subclass is indented under subclass 85. Processes wherein the preliminary treatment is a treatment of the mineral oil feed with a solvent which separates therefrom some component of the mineral oil which may be nonmineral oil component or a mineral oil fraction.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

311+, for mineral oil fractionation involving the use of solvent extraction.

**88 Refining:**

This subclass is indented under subclass 85. Processes wherein the preliminary treatment of the mineral oil includes the removal of nonhydrocarbon impurities or the conversion of the impurity to an inactive form.

(1) Note. Many of the patents classified herein involve the removal of or the inactivation of impurities which would tend to inactivate or reduce the activity of (poison) the catalyst employed in a subsequent conversion process.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

87, for preliminary removal of impurities by means of solvent extraction.

177+, for processes for the removal of or inactivation of nonhydrocan impurities occurring in mineral oil.

**89 With hydrogen:**

This subclass is indented under subclass 88. Processes wherein the refining treatment of the mineral oil includes the use of hydrogen, either in the free state or by means of a hydrogen rich material (hydrogen donor).

SEE OR SEARCH THIS CLASS, SUB-CLASS:

58+, for plural serial stage conversion processes wherein the first stage is hydrodesulfurization under cracking conditions.

209+, for processes of removing sulfur from mineral oil wherein hydrogen is used.

264, for processes of refining employing free hydrogen.

**90 With acids:**

This subclass is indented under subclass 88. Processes wherein the refining treatment includes the use of a free acid.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

219+, 252 and 265+, for refining processes wherein an acid is used.

**91 With solid adsorbents:**

This subclass is indented under subclass 88. Processes wherein the refining treatment includes a treatment of the mineral oil with solid adsorbents.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

213+, and 299+, for refining processes, per se, wherein solid adsorbents are used to refine the oil.

**92 Distillation:**

This subclass is indented under subclass 85. Processes wherein the mineral oil to be converted is subjected to distillation prior to the conversion reaction.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

80, for processes including a fractionation of a feed oil preliminary to a treatment of both fraction (split feed).

347+, for processes of distilling mineral oils, wherein there is no conversion of the mineral oil.

**93 With blending of products of distillation with each other or with converted products:**

This subclass is indented under subclass 92. Processes wherein at least one of the fractions produced by the distillation is blended with

- either (1) another of the said fractions or (2) with the product of the conversion reaction or a fraction thereof.
- 94 Plural stages of distillation:**  
This subclass is indented under subclass 92. Processes wherein the mineral oil to be converted is subjected to two or more successive distillation stages prior to conversion.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
354+, and 364+, for processes of distilling mineral oils in plural stages wherein there is no conversion of the oil.
- 95 With subsequent treatment of products:**  
This subclass is indented under subclass 46. Processes in which a mineral oil conversion step is combined with a subsequent separate and distinct nonconversion treatment of the mineral oil products of the conversion.
- (1) Note. Processes which include a single subsequent treatment defused by name only, or include the separation and removal of the catalyst or inert material employed in the process as the only subsequent treatment are not included in this or indented subclass.
- 96 Solvent extraction:**  
This subclass is indented under subclass 95. Processes wherein the treatment subsequent to conversion includes treatment of the product with a solvent which dissolves and separates therefrom a component of the product which may be a nonmineral oil component or a mineral oil fraction.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
311+, for mineral oil fractionation involving the use of solvent extraction.
- 97 Refining:**  
This subclass is indented under subclass 95. Processes wherein the treatment subsequent to conversion includes the removal of nonhydrocarbon natural occurring material (impurity) from the mineral oil, or the conversion thereof to an inactive or unobjectionable material.
- (1) Note. Processes which include a single subsequent treatment defused by name only, or include the separation and removal of the catalyst or inert material employed in the process as the only subsequent treatment are not included in this or indented subclass.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
177+, for processes for the removal of or inactivation of nonhydrocarbon impurities occurring in mineral oil.
- 98 With acids:**  
This subclass is indented under subclass 97. Processes wherein the refining treatment includes the use of an acid.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
219+, 252, 256, and 265+, for refining processes wherein an acid is used.
- 99 With solid adsorbents:**  
This subclass is indented under subclass 97. Processes wherein the refining treatment includes the use of solid adsorbents.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
213+, and 299+, for refining processes wherein adsorbents are used.
- 100 Separation of vapors and liquid products:**  
This subclass is indented under subclass 95. Processes wherein the treatment of the products subsequent to conversion includes a separation of vapor products from liquid involving (1) plural stages of separation, (2) a specifically defined separation procedure or (3) the recovery of particular fractions identified by some property thereof, (e.g., specific boiling range).
- (1) Note. Broadly recited single stage separations, as for example, broad rectification, to recover named fractions such as gasoline, gas oil, etc., are not included herein as a subsequent treatment.

- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
347+, for processes of distilling mineral oils.
- 101 With absorption with liquid:**  
This subclass is indented under subclass 100. Processes wherein the separation process includes an absorption of one of the components of the vapor products with a liquid absorbent.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
341+, for processes of recovering mineral oils from vapors by absorption followed by vaporization to recover the mineral oil from the absorbent oil.
- SEE OR SEARCH CLASS:  
95, Gas Separation: Processes, for processes of gas separation, particularly subclasses 149+ for gas separation involving liquid contacting.
- 102 With additional separation of liquid products from primary separation zone:**  
This subclass is indented under subclass 100. Processes wherein the liquid product resulting from one separation step is subjected to a further separation of vapors from the liquid.
- 103 With additional separation of vapor products:**  
This subclass is indented under subclass 100. Processes wherein the vapor product resulting from one separation step is subject to a further vapor from liquid separation.
- 104 With distillation of second stage liquid:**  
This subclass is indented under subclass 103. Processes wherein liquid product from the second separation step is additionally subjected to distillation to separate the same into desired fractions.
- 105 With condensation of second stage vapors:**  
This subclass is indented under subclass 103. Processes wherein vapors from the second separation step are subjected to a condensation treatment to produce liquid products.
- 106 Cracking:**  
This subclass is indented under subclass 46. Processes wherein hydrocarbons are converted into a mixture including lighter, lower boiling hydro-carbons which are liquid at atmospheric temperature and pressure, or to coke.
- (1) Note. Cracking operations which result in the formation of product coke is generally known as "coking". Cracking operations conducted under heat and pressure and in the absence of a catalyst is known as "thermal cracking".
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
50+, for plural serial stage conversions wherein at least one of the stages includes a coking of a mineral oil.  
67+, for plural serial stage conversions wherein the first stage is a thermal or a catalytic cracking of a mineral oil.
- SEE OR SEARCH CLASS:  
48, Gas: Heating and Illuminating, particularly subclasses 211+ for processes of cracking an oil to produce a gaseous hydrocarbon, having utility as a heating or illumination gas.
- 107 Hydrogenative:**  
This subclass is indented under subclass 106. Processes wherein the cracking takes place in the presence of added hydrogen.
- (1) Note. Hydrogenative cracking is generally referred to as destructive hydrogenation.
- (2) Note. The hydrogen may be added as a free gas or a hydrogen rich material may be used under such conditions as to generate or liberate hydrogen (hydrogen donor processes).
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
56, for, hydrogen donor diluent cyclic processes which includes hydrogenation reactions.  
58+, for plural serial stage conversions, the first stage of which is a hydrogenative cracking.

**108 Catalytic:**

This subclass is indented under subclass 107. Processes in which a catalytic material is employed.

- (1) Note. To be classified in this or indented subclasses the process must include (a) the treatment of a specific mineral oil identified by some definite physical or chemical property thereof, such as boiling range, specific gravity, etc., or (b) the use of a specifically identified catalytic material. Merely identifying the feed as a naphtha, as boiling within the gas-oil range or the use of a catalyst of a particular size is not itself sufficient to cause classification in this or indented subclass. Processes excluded by this note are classified below in subclass 146 which provides for mineral oil processes including the contacting of the oil with solids.

SEE OR SEARCH THIS CLASS, SUBCLASS:

146+, for manipulative processes of contacting of mineral oils with solid catalysts. (See (1) Note).

SEE OR SEARCH CLASS:

502, Catalyst, Solid Sorbent, or Support Therefor: Product or Process of Making, for a composition comprising a catalyst or sorbent, per se.

**109 Silica or silicate containing catalyst:**

This subclass is indented under subclass 108. Processes wherein the catalytic material contains silica or a silicate.

**110 With metal or metal oxide:**

This subclass is indented under subclass 109. Processes wherein the catalyst includes a free metal or metal oxide.

- (1) Note. Combinations of a metal oxide and silica are classified herein even though they are combined in the form of a metal silicate. Similarly metal salts of amphoteric metals, for example, metal chromate are classified herein as mixtures of metal oxides.

**111.01 With group III metal, rare earth metal, or metal oxide (i.e., Sc, Y, Al, Ga, In, Tl, metal of atomic number 57-71, or oxide thereof):**

This subclass is indented under subclass 110. Processes wherein the catalytic material includes a group III metal, a rare earth metal, or oxide thereof.

- (1) Note. The catalysts used in the processes classified herein include the combination of alumina and silica gels, whether obtained separately or simultaneously, as well as the aluminum silicates.

**111.05 With group VII metal or metal oxide (i.e., Mn, Tc, Re, or oxide thereof):**

This subclass is indented under subclass 111.01. Processes wherein the catalytic material includes a group VII metal or oxide thereof.

**111.1 With group IV metal or metal oxide (i.e., Ti, Zr, Hf, Ge, Sn, Pb, or oxide thereof):**

This subclass is indented under subclass 111.01. Processes wherein the catalytic material includes a group IV metal or oxide thereof.

**111.15 With group I metal or metal oxide (i.e., alkali metal, Ag, Au, Cu, or oxide thereof):**

This subclass is indented under subclass 111.01. Processes wherein the catalytic material includes a group I metal or oxide thereof.

- (1) Note. The alkali metals are lithium (Li), sodium (Na), potassium (K), rubidium (Rb), cesium (Cs), and francium (Fr).

**111.2 With group V metal or metal oxide (i.e., V, Nb, Ta, As, Sb, Bi, or oxide thereof):**

This subclass is indented under subclass 111.01. Processes wherein the catalytic material includes a group V metal or oxide thereof.

**111.25 With group II metal or metal oxide (i.e., alkaline earth metal, Be, Mg, Zn, Cd, Hg, or oxide thereof):**

This subclass is indented under subclass 111.01. Processes wherein the catalytic material includes a group II metal or oxide thereof.

- (1) Note. The alkaline earth metals are calcium (Ca), strontium (Sr), barium (Ba), and radium (Ra).

**111.3 With group VI metal or metal oxide (i.e., Cr, Mo, W, Po, or oxide thereof):**

This subclass is indented under subclass 111.01. Processes wherein the catalytic material includes a group VI metal or oxide thereof.

**111.35 With group VIII metal or metal oxide (i.e., iron or platinum group metal, or oxide thereof):**

This subclass is indented under subclass 111.01. Processes wherein the catalytic material includes a group VIII metal or oxide thereof.

- (1) Note. The iron group metals are iron (Fe), cobalt (Co), and nickel (Ni). The platinum group metals are ruthenium (Ru), rhodium (Rh), palladium (Pd), osmium (Os), iridium (Ir), and platinum (Pt).

**112 Metal or metal oxide catalyst:**

This subclass is indented under subclass 108. Processes wherein the catalytic material contains a free metal or a metal oxide.

- (1) Note. Metal salts of an amphoteric metal, e.g., metal chromates are classified herein as a mixture of metal oxides (chromium oxide with the other metal oxide).

**113 Catalytic:**

This subclass is indented under subclass 106. Processes in which a catalytic material is employed.

- (1) Note. To be classified in this or indented subclasses the process must include (a) the treatment of a specific mineral oil identified by some definite physical or chemical property thereof, such as boiling range, specific gravity, etc., or (b) the use of a specifically identified catalytic material. Merely identifying the feed as a naphtha, as boiling within the gas-oil range or the use of a catalyst of a particular size is not itself sufficient to cause classification in this or indented subclasses. Processes excluded by this note are classified below in subclasses 146+ which provides for mineral oil processes

including the contacting of the oil with solids.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 146+, for manipulative contacting processes which are of general application even though claimed as "catalytic cracking" (see (1) Note).

SEE OR SEARCH CLASS:

- 502, Catalyst, Solid Sorbent, or Support Therefor: Product or Process of Making, for a composition comprising a catalyst or sorbent, per se.

**114 Phosphorus, boron or nitrogen containing catalyst:**

This subclass is indented under subclass 113. Processes wherein the catalyst contains phosphorus, boron, nitrogen either as a free element or as a compound thereof.

**115 Halogen containing catalyst:**

This subclass is indented under subclass 113. Processes wherein the catalyst contains a halogen either as a free element or as a compound thereof.

**116 Metal halide:**

This subclass is indented under subclass 115. Processes wherein the catalyst includes a metal halide.

**117 Group III metal halide:**

This subclass is indented under subclass 116. Processes wherein the catalyst includes a Group III metal halide.

**118 Silica or silicate containing catalyst:**

This subclass is indented under subclass 113. Processes wherein the catalyst contains silica or a silicate.

**119 With metal or metal oxide:**

This subclass is indented under subclass 118. Processes wherein the catalyst also contains a free metal or a metal oxide.

- (1) Note. Combinations of a metal oxide and silica are classified herein even though they are combined in the form of a metal silicate. Similarly metal salts of amphoteric metals, for example, metal chromate

are classified herein as mixtures of metal oxides.

**120.01 With group III metal, rare earth metal, or metal oxide (i.e., Sc, Y, Al, Ga, In, Tl, metal of atomic number 57-71, or oxide thereof):**

This subclass is indented under subclass 119. Processes wherein the catalytic material includes a group III metal, rare earth metal, or oxide thereof.

**120.05 With group VII metal or metal oxide (i.e., Mn, Tc, Re, or oxide thereof):**

This subclass is indented under subclass 120.01. Processes wherein the catalytic material includes a group VII metal or oxide thereof.

**120.1 With group IV metal or metal oxide (i.e., Ti, Zr, Hf, Ge, Sn, Pb, or oxide thereof):**

This subclass is indented under subclass 120.01. Processes wherein the catalytic material includes a group IV metal or oxide thereof.

**120.15 With group I metal or metal oxide (i.e., alkali metal, Ag, Au, Cu, or oxide thereof):**

This subclass is indented under subclass 120.01. Processes wherein the catalytic material includes a group I metal or oxide thereof.

- (1) Note. The alkali metals are lithium (Li), sodium (Na), potassium (K), rubidium (Rb), cesium (Cs), and francium (Fr).

**120.2 With group V metal or metal oxide (i.e., V, Nb, Ta, As, Sb, Bi, or oxide thereof):**

This subclass is indented under subclass 120.01. Processes wherein the catalytic material includes a group V metal or oxide thereof.

**120.25 With group II metal or metal oxide (i.e., alkaline earth metal, Be, Mg, Zn, Cd, Hg, or oxide thereof):**

This subclass is indented under subclass 120.01. Processes wherein the catalytic material includes a group II metal or oxide thereof.

- (1) Note. The alkaline earth metals are calcium (Ca), strontium (Sr), barium (Ba), and radium (Ra).

**120.3 With group VI metal or metal oxide (i.e., Cr, Mo, W, Po, or oxide thereof):**

This subclass is indented under subclass 120.01. Processes wherein the catalytic material includes a group VI metal or oxide thereof.

**120.35 With group VIII metal or metal oxide (i.e., iron or platinum group metal, or oxide thereof):**

This subclass is indented under subclass 120.01. Processes wherein the catalytic material includes a group VIII metal or oxide thereof.

- (1) Note. The iron group metals are iron (Fe), cobalt (Co), and nickel (Ni). The platinum group metals are ruthenium (Ru), rhodium (Rh), palladium (Pd), osmium (Os), iridium (Ir), and platinum (Pt).

**121 Metal or metal oxide containing catalyst:**

This subclass is indented under subclass 113. Processes wherein the catalyst contains a metal or metal oxide.

- (1) Note. Metal salts of an amphoteric metal, e.g., metal chromates are classified herein as a mixture of metal oxides (chromium oxide with the other metal oxide).

**122 Group III metal or oxide:**

This subclass is indented under subclass 121. Processes wherein the catalyst includes a Group III metal or metal oxide.

**123 With Group VI metal or oxide:**

This subclass is indented under subclass 122. Processes wherein the catalyst additionally contains a Group VI metal or metal oxide.

**124 With Group VIII metal or oxide:**

This subclass is indented under subclass 122. Processes wherein the catalyst additionally contains a Group VIII metal or metal oxide.

**125 With nonreactive material:**

This subclass is indented under subclass 106. Processes wherein cracking takes place in the presence of an added nonreactive material.

- (1) Note. The processes classified in this and indented subclasses are thermal cracking processes wherein the mineral oil is either converted to lower boiling mineral oils or to coke and wherein nonreactive liquids, vapors or solids are added prior to or during the conversion to facilitate the same.

### 126 Solids:

This subclass is indented under subclass 125. Processes wherein cracking takes place in the presence of added inert solids.

- (1) Note. Many processes classified herein are directed to cracking in the presence of heat carriers which may cause formation of coke in addition to lighter hydrocarbon products. The heat carriers may be coke solids or inert refractory materials. The process is generally known as "coking".
- (2) Note. To be classified in this or indented subclasses the process must include (a) the treatment of a specific mineral oil identified by some definite physical or chemical property thereof, such as boiling range, specific gravity, etc., or (b) the use of a specifically identified solid material. Merely identifying the feed as a naphtha, as boiling within the gas oil range, or the use of solids of a particular size is not sufficient to cause classification of the process in this or indented subclass. Processes excluded are classified below in subclass 146.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 50+, for plural serial stage conversions wherein at least one of the conversions includes a coking of mineral oil.
- 146+, for manipulative contacting of mineral oils with solids (see (2) Note).

SEE OR SEARCH CLASS:

- 196, Mineral Oils: Apparatus, subclasses 104+ for apparatus for coking a mineral oil and treating vapor products (e. g., fractionating the mineral oil product).

- 201, Distillation: Processes, Thermolytic, subclass 23 for a process of coking a carbonaceous mixture including a minor amount of mineral oil.
- 202, Distillation: Apparatus, appropriate subclasses for apparatus for coking a mineral oil.
- 423, Chemistry of Inorganic Compounds, subclasses 449.1+ for manufacturing carbon by a chemical reaction.

### 127 Suspension system:

This subclass is indented under subclass 126. Processes wherein cracking takes place in the presence of added inert solids which are suspended in a fluid medium, the mixture being handled as a fluid.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 153+, for processes of conversion including the use of solid materials suspended in a fluid wherein neither the mineral oil treated nor the solids is specifically identified.

### 128 Vapors:

This subclass is indented under subclass 125. Processes wherein cracking takes place in the presence of an added gas or vapor.

### 129 Combustion gases:

This subclass is indented under subclass 128. Processes wherein the cracking takes place in the presence of added gaseous products of combustion of a gaseous, liquid or solid fuel.

### 130 Steam:

This subclass is indented under subclass 128. Processes wherein cracking takes place in the presence of steam.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 7, for processes of cracking which also involves oxidation by means of oxygen which may be evolved from the decomposition of steam.
- 107+, for processes of hydrogenative cracking employing hydrogen evolved from steam.

**131 Soaking:**

This subclass is indented under subclass 106. Processes wherein mineral oil to be cracked is heated to the desired temperature and cracking takes place due solely to the heat stored during the initial heating, no further heat being added during the progress of the cracking operation.

- (1) Note. Processes classified herein generally result in the making of product coke, the process being generally known as "coking".

SEE OR SEARCH CLASS:

423, Chemistry of Inorganic Compounds, subclasses 449.1+ for manufacturing carbon by a chemical reaction.

**132 With heating in tubular confined stream:**

This subclass is indented under subclass 106. Processes wherein the feed oil to be cracked (or coked) is heated in a continuous confined zone of generally tubular configuration.

- (1) Note. The conversion reaction may be initiated in the heating zone but additional heat is required to continue the reaction to completion.

SEE OR SEARCH THIS CLASS, SUBCLASS:

131, for similar cracking processes wherein heating of the feed oil may be accomplished in a tubular confined zone but no additional heat is required to continue the cracking (or coking) operation.

**133 Reforming (includes dehydrogenation, isomerization, cyclization, aromatization, alkylation, dealkylation reactions):**

This subclass is indented under subclass 46. Processes wherein a mineral oil is converted to an oil of similar boiling range, but of generally improved octane rating, the reaction being known as reforming.

- (1) Note. A reforming process generally includes a number of different reactions of the hydrocarbon molecule, including dehydrogenation, isomerization, aromatization, cyclization, alkylation and/or dealkylation. The subjecting of a mineral

oil to any of the above mentioned reactions is classified in this or indented subclass.

- (2) Note. The feed oil in the processes classified herein is generally a naphtha, although special fractions thereof may similarly be treated, the feed oil in these processes being of generally more volatile nature than the feed to a cracking process.

**134 Catalytic:**

This subclass is indented under subclass 133. Processes wherein reforming takes place in the presence of catalytic material.

- (1) Note. To be classified in this or indented subclasses the process must include (a) the treatment of a specific mineral oil identified by some definite physical or chemical property thereof, such as boiling range, specific gravity, etc., or (b) the use of a specifically identified catalytic material. Merely identifying the feed as a naphtha, as boiling within the gas-oil range or the use of a catalyst of a particular size is not itself sufficient to cause classification in this or indented subclass. Processes excluded by this note are classified below in subclasses 146+ which provides for mineral oil processes including the contacting of the oil with solids.

SEE OR SEARCH THIS CLASS, SUBCLASS:

146+, for manipulative processes of contacting mineral oils with catalysts (see (1) Note).

**135 With Group III metal or metal oxide containing catalyst:**

This subclass is indented under subclass 134. Processes wherein the catalytic material contains a Group III metal or metal oxide.

- (1) Note. Metal salts of Group III amphoteric metal (metal aluminates) are classified in this or indented subclass as mixtures of metal oxides.

**136 With Group VI metal or metal oxide:**

This subclass is indented under subclass 135. Processes wherein the catalyst additionally contains a Group VI metal or metal oxide.

**137 With Group VIII metal or metal oxide:**

This subclass is indented under subclass 135. Processes wherein the catalyst additionally contains a Group VIII metal or metal oxide.

**138 Noble metal or oxide thereof:**

This subclass is indented under subclass 137. Processes wherein the catalyst includes a noble metal or metal oxide.

SEE OR SEARCH THIS CLASS, SUBCLASS:

65, for processes involving plural serial stage reforming conversions wherein a noble metal containing catalyst is used in at least one of the stages.

**139 With halogen containing additive:**

This subclass is indented under subclass 138. Processes wherein the catalyst additionally contains an added halogen.

**140 With recovery or reactivation of catalyst:**

This subclass is indented under subclass 138. Processes combined with the subsequent recovery of or the treatment of the catalyst to rehabilitate the same to condition for reuse.

SEE OR SEARCH CLASS:

502, Catalyst, Solid Sorbent, or Support Thereof: or Process of Making, comprising a catalyst or sorbent, per se, and see especially subclasses 12 and 20+ for a process of regeneration of such composition.

**141 Feed of specific composition:**

This subclass is indented under subclass 134. Processes directed to the catalytic reforming of a specifically identified mineral oil.

(1) Note. To be classifiable in this subclass the process must include the treatment of a mineral oil identified by some definite chemical or physical property such as the boiling range, specific gravity, etc. Merely naming the oil as paraffinic, ole-

finic, etc., is not sufficient, per se, to identify the mineral oil for this subclass.

**142 Hydrogenation (saturation):**

This subclass is indented under subclass 46. Processes wherein mineral oil is subjected to treatment with added free hydrogen or under conditions which generate hydrogen and in which hydrogen is added to the hydrocarbon molecule to saturate at least some of the unsaturated molecules therein.

SEE OR SEARCH THIS CLASS, SUBCLASS:

56, and 57, for plural serial stage conversions wherein one of the conversion stages includes a hydrogenation reaction.

**143 Catalytic:**

This subclass is indented under subclass 142. Processes wherein hydrogenation takes place in the presence of catalytic material.

(1) Note. To be classified in this or indented subclasses the process must include (a) the use of a specifically identified solid catalytic material, or (b) the treatment of a specific mineral oil identified by some definite physical or chemical property thereof, such as boiling range, specific gravity, etc. Processes of this latter type are specifically provided for in subclasses 144+ indented hereunder. Processes excluded by this note are classified below in subclasses 146+ which provides for broadly claimed processes of contacting mineral oil with solids.

SEE OR SEARCH THIS CLASS, SUBCLASS:

144, (see (1) Note).

146, (see (1) Note).

**144 Feed of specific composition:**

This subclass is indented under subclass 143. Processes directed to the catalytic hydrogenation of a specifically identified mineral oil.

(1) Note. To be classifiable in this subclass the process must include the treatment of a mineral oil identified by some definite chemical or physical property such as

the boiling range, specific gravity, etc. Merely naming the oil as paraffinic, olefinic, et., is not sufficient, per se, to identify the mineral oil for this subclass.

**145 With added source of hydrogen (includes hydrogen donor):**

This subclass is indented under subclass 144. Processes in which an added material which under the conditions of the reaction supplies the hydrogen necessary for hydrogenation is employed.

- (1) Note. Such hydrogen supplying materials are commonly known as "hydrogen donors". Example thereof are naphthenes, asphalts, and tars.

SEE OR SEARCH THIS CLASS, SUBCLASS:

56, for hydrogen donor diluent cyclic processes.

**146 Solids contacting and mixing:**

This subclass is indented under subclass 46. Processes which are directed to contacting fluid, in either the liquid or vapor state, and which may include, in addition to the mineral oil treated a solids regenerating or rehabilitating fluid with solids, and which are neither directed to the treatment of a specifically identified mineral oil nor include the use of specifically identified solids.

- (1) Note. Process of (a) treating a mineral oil identified by some definite physical or chemical property such as the boiling range, specific gravity, etc., or (b) using a specifically identified catalyst or heat carrier, are classified in a preceding subclass providing for the process involved. Processes classifiable in this or indented subclass may identify the process as hydrocracking, reforming, etc., or be directed to the treatment of a naphtha, feed boiling within the "gas oil range" (without giving the temperature range) or specify the use of a catalyst of a particular particle size.
- (2) Note. Processes of conversion of mineral oil which involve a plurality of named conversion steps (of the same type or of a different type) or which are in combi-

nation with a preliminary treatment of the feed oil or a subsequent treatment of the converted products are classified in the preceding subclass providing for the combination, (subclasses 49 to 105) even though the conversion treatment is only broadly defined.

- (3) Note. In this and indented subclasses is intended to be collected processes of converting mineral oil which are distinguished primarily by the manipulative procedure in which solids (catalysts or inert solids) are contacted with a fluid, in the liquid or gaseous state which may be either the mineral oil to be converted or a solids regeneration medium (e.g., oxygen or air).

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 49+, for processes in which a mineral oil is subjected to a plurality of successive conversions (see (2) Note).
- 78+, for processes including plural parallel conversions (see (2) Note).
- 85+, for processes including a treatment of mineral oil prior to conversion (see (2) Note).
- 95+, for processes including a treatment of the converted products (see (2) Note).

SEE OR SEARCH CLASS:

- 34, Drying and Gas or Vapor Contact With Solids, appropriate subclasses, which is the generic class providing for processes and apparatus for contacting solids with either gases or vapors.
- 134, Cleaning and Liquid Contact With Solids, appropriate subclass, which is the generic class providing for processes and apparatus for contacting solids with liquids.
- 165, Heat Exchange, subclasses 104.11+ for a heat exchange system in which an intermediate fluent receives and discharges heat, and subclasses 4+ for a heat exchanger having a solid heat storage mass.
- 406, Conveyors: Fluid Current, appropriate subclasses, for processes and apparatus for conveying solid materi-

- als by means of or with the assistance of a forced propelling fluid current.
- 414, Material or Article Handling, for processes or apparatus for handling materials including manipulative charging and discharging of solids, per se.
- 422, Chemical Apparatus and Process Disinfecting, Deodorizing, Preserving, or Sterilizing, especially subclasses 631 through 638 and 211+ for apparatus for treating a material (including mineral oil) with a catalyst.
- 502, Catalyst, Solid Sorbent, or Support Therefor: Product or Process of Making, for a composition comprising a catalyst or sorbent, per se, and see especially subclasses 12 and 20+ for a process of regenerating such composition. Combinations of treating mineral oil in the presence of solids with regeneration of the solids employed are classified in this class (208) and in this or an indented subclass when the mineral oil conversion is claimed broadly.
- 147 Separate contiguous, dissimilar function, contacting zones:**  
This subclass is indented under subclass 146. Processes wherein a plurality of dissimilar reactions are carried out within the same enclosure or chamber, which reactions take place in zones which are separated by a common wall, through which heat exchange generally takes place.
- (1) Note. The reactions involved may be a conversion and catalyst regeneration or a plurality of unnamed conversions.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
49, through 80, for processes involving a plurality of named conversions including the use of plural contiguous reaction zones.
- 148 Combined gravitating bed and suspension zones:**  
This subclass is indented under subclass 146. Processes which include both fluid contact with a gravitating compact bed of solids and contact with solids while suspended in the fluid.
- (1) Note. This subclass contains, for example, those plural stage unnamed conversions but which embody the two different types of moving system conversions or where the solids are regenerated during movement as a gravitating bed and are elevated by pneumatic lifting, the lift gas including mineral oil which is simultaneously converted in the lift zone, the solids being in a suspension state during this reaction.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
174+, for gravitating compact bed type contacting including the transfer of solids between compact bed zones by entraining the solids in a suspending gas stream.
- 149 Solids of dissimilar composition:**  
This subclass is indented under subclass 146. Processes wherein fluid is contacted with a mixture of different types of solids in the same zone.
- (1) Note. Processes classified herein involve the contact of a fluid with a mixture of a catalyst and heat carrier solids (both unnamed).
- 150 Purging:**  
This subclass is indented under subclass 146. Processes which include a significant treatment of the contact solid to remove therefrom adsorbed or occluded material, other than contaminant coke or carbon.
- (1) Note. Treatments to remove contaminant coke or carbon are not included herein even though the treatment may simultaneously remove other occluded or adsorbed material.
- (2) Note. "Purging" or "stripping" claimed broadly by name only or processes including broadly the use of steam as a stripping medium are not considered significant purging or stripping steps for this subclass. The use of steam in a particular manner, e.g., with agitation, or the use of other purging mediums to remove occluded hydrocarbons, flue

gases, etc., are examples of significant purging for this subclass.

**SEE OR SEARCH CLASS:**

34, Drying and Gas or Vapor Contact With Solids, subclasses 402 and 443+ for processes of contacting solids with gases, as for example for drying.

**151 Plural stages:**

This subclass is indented under subclass 150. Processes wherein the purging takes place in a series of separate and distinct stages.

**152 Solids replenishment, or selective discard:**

This subclass is indented under subclass 146. Processes wherein during the contacting process solids are added to the system to make up losses or selected fractions of the solids are withdrawn from the system.

- (1) Note. This subclass contains, for example, those solids contacting processes wherein (a) catalyst is added to the circulating mass to maintain constant catalyst inventory and thus replenish normal losses to maintain a constant average catalytic activity, or; (b) solids below the desired catalytic activity are discarded from the system or solids that are too fine or have grown in size are discarded thereby preventing any interruption of normal solids flow in the system.

**153 Suspension system:**

This subclass is indented under subclass 146. Processes wherein solids are suspended in a fluid medium, and the mineral oil conversion or solids regeneration or rehabilitation takes place in the presence of the suspended solids.

- (1) Note. The suspending medium may be either a liquid or a gas or vapor, and the suspension may flow similar to a liquid from a point of high elevation or pressure to one of lower elevation or pressure, or the solids may be suspended in an upward flowing fluid (fluidized dense bed), or even flow in an upward direction with the fluid, e.g., dilute or transfer line system.

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

127, for processes of cracking in the presence of inert solids (coking) employing this type of system.

**SEE OR SEARCH CLASS:**

201, Distillation: Processes, Thermolytic, subclass 12 for a thermolytic distillation process in which the charge is heated by contact with a hot dispartate, inert solid and subclass 31 for a fluidized bed process.

502, Catalyst, Solid Sorbent, or Support Therefor: Product or Process of Making, especially subclasses 20+ for a process of regeneration, per se, of a composition of that class.

**154 Start-up and shut down procedures:**

This subclass is indented under subclass 153. Processes which include the step of starting up the operation fluid suspension system or of shutting down the operation of the suspension system.

- (1) Note. Many of the processes found herein have for their object to properly heat up or cool down the system or the prevention of explosions therein.

**155 Plural zones of similar function:**

This subclass is indented under subclass 153. Processes which include (1) a plurality of separate unnamed mineral oil conversions (2) a plurality of separate solids regenerations or rehabilitations, or (3) a plurality of zones in which mineral oil conversions occur alternately with solids regeneration or rehabilitation.

- (1) Note. Plural mineral oil conversion processes classified herein are claimed broadly as "mineral oil conversion" for example and may be disclosed as being of different type, e.g., cracking and reforming. The zones are generally associated with a common solids supply or reactant supply.

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

49+, for processes in which a mineral oil is subjected to a plurality of successive

- named chemical conversion reactions (see (1) Note).
- 78+, for mineral oil conversion processes involving plural parallel stages of chemical conversion wherein the reactions are identified at least by name (see (1) Note).
- 156 Solids and contacting fluids are both in series:**  
This subclass is indented under subclass 155. Processes in which both the fluid and the solids contacted thereby are passed from one reaction zone to the other reaction zone successively, either counter-current to each other or concurrent with each other.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
49+, for plural serial stages of named mineral oil conversion processes.
- 157 Liquid feed:**  
This subclass is indented under subclass 153. Processes wherein mineral oil to be converted is introduced into the reaction zone in the liquid state.
- (1) Note. This subclass contains, for example, those contacting processes wherein the liquid feed to the suspension system remains in the liquid state and the entire system is in liquid suspension or wherein the liquid feed is vaporized by the hot solids and the entire system is in the vapor phase or wherein there is a mixed vapor-liquid feed and the vapors are in equilibrium with the liquid in the vapor-liquid suspension. Many of the techniques classified here result in uniform wetting and contacting of the solids and prevent agglomerating or sticking of the particles due to the use of a heavy liquid feed.
- 158 With augmented turbulence (in addition to normal mixing in bed):**  
This subclass is indented under subclass 153. Processes wherein the suspended solids are subjected to some step to increase the turbulence or mixing thereof which increases the motion of the solids beyond that necessary to maintain the solids suspension.
- (1) Note. Additional mixing or turbulence may, for example, be accomplished by use of a mechanical stirrer or by applying some vibrations to the solids suspension.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
163+, for processes including steps for decreasing the solids mixing in a fluidized bed by retarding the top to bottom movement of the particles.
- 159 With temperature regulation:**  
This subclass is indented under subclass 153. Processes involving the control of the temperature during the fluid-solid contacting over and above that caused by the normal heat transfer properties of the moving solid bodies as they circulate in and through the system.
- (1) Note. This subclass contains, for example, processes of regulating temperature in mineral oil conversion in a suspension system wherein heating and cooling occurs by indirect heat exchange or by some specific manipulation of the circulating solids to cause such change in the temperature.
- (2) Note. Preheating the feed or quenching the products of the reaction are not regarded as temperature controls within the scope of this subclass.
- 160 By solids circulation to external heat exchange and return to same zone:**  
This subclass is indented under subclass 159. Processes wherein the temperature is controlled by removing a portion of the solids, circulating the same to an external heat exchange, and then back to the zone from which they were removed.
- (1) Note. This technique may be used to reheat solids which have been used as heat carriers or to cool overheated solids.
- (2) Note. Excluded from this subclass are processes in which spent solids are reheated merely by the regeneration operation.

**161 Separation of entrained fines from effluents:**

This subclass is indented under subclass 153. Processes which include a specifically recited step of removing finely divided solids from the effluent gas from the reaction zone.

- (1) Note. Particles of 20 microns in diameter and less are considered fines for classification in this subclass. Processes wherein the separation of fines is (1) claimed broadly by name only or (2) recites broadly the use of centrifugal force or of a "cyclone" are not classified herein unless the separated fines are returned other than by gravity to the zone from which the effluent comes.

**162 In presence of a liquid:**

This subclass is indented under subclass 161. Processes wherein the fines separation is facilitated by use of a liquid.

- (1) Note. The liquid may act to agglomerate the fines. The liquid may be formed in situ by partial condensation of effluent vapor or may be an added liquid. The technique may involve counter-current scrubbing of the effluent product. Subsequent treatments of the resulting slurry of fines such as washing or filtering the same may be included, per se, as necessarily involving a separation of fines from the effluent in the presence of a liquid.

**163 Fluidized dense bed:**

This subclass is indented under subclass 153. Processes in which solids are suspended in upward flowing gas or vapor, the upward force of the fluid on the solids is countered by gravity resulting in the formation of a zone in which the particles are compacted into a dense phase.

- (1) Note. The particles are in a state of hindered settling and the dense bed resembles a boiling liquid and above this dense bed some solids may be suspended in a dilute or dispersed phase.

**164 Solids transferring:**

This subclass is indented under subclass 163. Processes which include a specifically recited procedure for transferring solids from one solids suspension zone to another.

- (1) Note. Processes classifiable herein may include the transfer of solids between fluidized dense beds or between such a bed and a zone having another type of solids suspension, as for example, a dispersed phase suspension of solids.
- (2) Note. Processes of transferring solids from zone to zone set out by name only are not included herein. The use of pressurizing and depressurizing zones is one example of transfer process included in this subclass.

**SEE OR SEARCH CLASS:**

406, Conveyors: Fluid Current, appropriate subclass for solids transfer or conveying by means of a fluid current.

**165 Gravitating compact beds:**

This subclass is indented under subclass 146. Processes wherein solids move downwardly by gravity as a relatively compact mass, the particles being in contact with each other and wherein the compactness is not disrupted by the contacting fluids.

**SEE OR SEARCH CLASS:**

502, Catalyst, Solid Sorbent, or Support Therefor: Product or Process of Making, for a composition comprising a catalyst or sorbent, per se, and see especially subclasses 20+ for a regeneration process which may include treatment by a contacting fluid.

**166 Liquid feeding:**

This subclass is indented under subclass 165. Processes wherein mineral oil to be contacted is introduced into the reaction zone in the liquid state.

- (1) Note. The feed may be all liquid or a mixed vapor-liquid phase feed and the procedure permits uniform contacting and wetting of the solids by the liquid

feed resulting in a uniform reactant flow through the compact bed.

**167 Solids curtain type:**

This subclass is indented under subclass 166. Processes wherein solids are introduced onto the surface of a compact bed as a freely falling stream or curtain and liquid mineral oil to be converted is sprayed against the freely falling curtain of solids.

- (1) Note. In many of the processes classified herein the curtain of falling solids prevents the liquid spray of mineral oil from contacting the walls of the reaction vessel.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 48, for mineral oil processes in which the accumulation of carbon deposits on the apparatus employed is prevented.

**168 Solids-vapor disengagement:**

This subclass is indented under subclass 165. Processes including a specific step of separating the effluent vapors or gases from the contacting zone from the solids and removed from the contacting zone.

- (1) Note. The disengagement technique generally involves an interruption or baffling of the solids flow to form a solids free zone into which vapors from the interstices of the bed flow and from which they can be removed.

**169 Plural zones of similar function (same chamber):**

This subclass is indented under subclass 165. Processes in which (1) a plurality of fluid streams separately contact a single stream of solids flowing through a series of gravitating compact bed zones or (2) a single stream of fluid serially contacts a plurality of gravitating compact bed zones wherein the solids flow in the zones is at least partially in parallel, all the contact zones being within the same chamber.

- (1) Note. Where the mineral oil conversion reaction is named in each of the zones, the original patent is classified above in subclasses 49+ or 78+. However, plural zone unnamed reactions of the same type

are classified herein whether the reactions are of the conversion or the regeneration type. The reaction or regeneration zones are generally associated with a common solids supply.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 49+, for processes of subjecting mineral oil to plural successive conversions. (See (1) Note).  
78+, for mineral oil conversion processes involving plural parallel stages of chemical conversion. (See (1) Note).

**170 Size stratification prevention:**

This subclass is indented under subclass 165. Processes which include some step to prevent the solids in the gravitating bed from becoming nonuniformly distributed as to particle size over the horizontal cross-section of the bed.

- (1) Note. The technique provided for in this subclass prevents sizing of the solids as might occur when solids are discharged onto the mass from a central point and the fines tend to sift downward to form a pile and coarser particles roll outward across the surface of the pile. A baffling of the flow, for example, will prevent this stratification of the different size particles.

**171 Uniform solids withdrawal:**

This subclass is indented under subclass 165. Processes including the step of removing the solids from the gravitating bed in such a manner that the solids are withdrawn uniformly over the horizontal cross-section of the bed.

- (1) Note. The technique provided for in this subclass prevents a flow of solids at some point within the bed at a greater velocity than at other points as might be the case if solids are withdrawn from a single centrally located point and the adjacent solids fill the gap created. Such techniques as baffling the flow of solids withdrawn or providing multi-point withdrawal of solids prevent the nonuniform flow within the bed by providing a uniform withdrawal of solids.

**172 Preheating or quenching with solids:**

This subclass is indented under subclass 165. Processes wherein (1) the heated solids, are employed to heat the fluid prior to entry to the gravitating bed or (2) cool solids are employed to extract and/or recover heat from the effluent from the gravitating bed zone.

- (1) Note. This subclass contains, for example, processes of maintaining a better thermal balance in the system by use of the solids to preheat the feed or cool the products. Undesirable side reactions may be prevented by quickly cooling the products below reaction temperatures.

**SEE OR SEARCH CLASS:**

165, Heat Exchange, subclasses 104.11+ for a heat exchange system in which a recycling intermediate fluent material receives and discharges heat.

**173 Solids transferring:**

This subclass is indented under subclass 165. Processes including a specific procedure for transferring solids from one compact gravitating bed zone to another.

- (1) Note. Processes which recite broad transferring of solids between zones by name only are not included. Some particular condition or procedure of transferring must be claimed.

**174 By pneumatic lifting:**

This subclass is indented under subclass 173. Processes wherein solids are taken from the discharge end of one gravitating compact bed and transferred to a more elevated inlet of another bed by entraining or suspending the solids gas stream.

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

148, for contacting processes wherein there are combined gravitating and suspension zones. Thus if a reaction occurs in the dispersed lift step (either a mineral oil conversion or a regeneration, stripping, etc., of the solids) the process is a combined gravitating bed and suspension zone process classified in subclass 148, whereas if the lift gas is

used for transfer purpose only, the process is classified in this subclass (174).

**SEE OR SEARCH CLASS:**

406, Conveyors: Fluid Current, subclasses 141+ and 174 for pneumatic lifting apparatus with no treating claimed.

**175 Compact type:**

This subclass is indented under subclass 174. Processes wherein the solid particles are maintained in contact with each other, the solids being transferred as a compact mass, usually by means of a force applied counter to the upward direction of flow of the conveying current.

**176 Solids moving processes:**

This subclass is indented under subclass 146. Processes which include the step of imparting motion of the solids being contacted.

- (1) Note. The solids particles may be moved relative to each other within a fixed mass or bed or motion may be imparted to the whole bulk of solids making up the bed. This subclass includes the movement of solids during fluid contacting or either before or after fluid contact. The movement is other than in a fluid suspending medium or as a gravitating bed. See Search This Class, Subclass, below.

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

153+, providing for movement of solids other than in a fluid suspending medium (see (1) Note).

165+, wherein solids move downwardly by gravity (see (1) Note).

**177 REFINING:**

This subclass is indented under the class definition. Processes for treating a mineral oil to (1) remove impurities or undesirable nonmineral oil components therefrom or (2) to inactivate these contaminants or impurities by converting them to some less noxious form, whether or not they are subsequently removed.

- (1) Note. An impurity is any component, usually a nonhydrocarbon, which renders the mineral oil less fit for use for its

intended purpose. Gum formers which are olefinic hydrocarbons and may be mineral oil components are regarded as impurities within the scope of the term "impurity" as are the gums formed by polymerization of such gum formers. Water is also regarded as an impurity.

- (2) Note. Certain subclasses indented hereunder (subclasses 179-186) provide for the treatment of a particular type of mineral oil while other subclasses (187-263) provide for a specific type of reaction or the removal of specified impurities. Processes are classified in the above mentioned subclasses when (1) the claims specify the particular impurity removed (or the treatment of used oil) or (2) the disclosure is limited to the removal of a single particular impurity (or the treatment of used oil). Processes wherein the claims do not specify the treatment of used oil or the impurity removed or treated and it is disclosed that a number of different impurities are removed or treated are classified in other indented subclass usually on the basis of the reagent employed. Patents classified on this latter basis may be cross-referenced to the subclasses for the impurities removed if necessary.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 88+, processes wherein a refining of mineral oil is combined with a subsequent conversion reaction.  
95+, processes including conversion of a mineral oil combined with a refining of the converted products.

SEE OR SEARCH CLASS:

- 196, Mineral Oils: Apparatus, subclass 46 for apparatus for refining mineral oils.  
210, Liquid Purification or Separation, appropriate subclass for processes and apparatus for separating or purifying liquids not elsewhere provided for. See the search notes in Class 210 for the line between that class and Class 208.  
516, Colloid Systems and Wetting Agents; Subcombinations Thereof; Processes

of Making, Stabilizing, Breaking, or Inhibiting, subclasses 113+ for compositions for or subcombination compositions for or breaking of or inhibiting of colloid systems (e.g., foam breaking, emulsion breaking, dispersion inhibiting, suspension settling, gel breaking, smoke suppressing, coagulating, flocculating), when generically claimed or when there is no hierarchically superior provision in the USPC for the specifically claimed art. Combinations of emulsion breaking and a treatment of the mineral oil provided for in Class 208 are classified in Class 208.

- 585, Chemistry of Hydrocarbon Compounds, subclasses 258+ and 800+ for processes of purifying particular hydrocarbons.  
588, Hazardous or Toxic Waste Destruction or Containment, subclasses 313 through 321 and 406 for the destruction of hazardous or toxic waste in the form of refined hydrocarbons.

#### 178 With reagent feed control:

This subclass is indented under subclass 177. Processes which includes the step of controlling of the amount of reagent employed in the refining of the mineral oil.

- (1) Note. Processes of control classified herein include more than the setting out of the amount of reagent employed. This subclass contains, for example, the step of controlling the rate of reagent introduction may be responsive to some condition of the feed as stopping the flow of the reagent when a determination is made that the amount of contaminant remaining is no longer harmful.

SEE OR SEARCH CLASS:

- 137, Fluid Handling, particularly subclasses 2+ and 87.01+ for processes and apparatus for proportioning the flow of two or more fluids not otherwise provided for.  
516, Colloid Systems and Wetting Agents; Subcombinations Thereof; Processes of Making, Stabilizing, Breaking, or Inhibiting, subclasses 113+ for compositions for or subcombination com-

positions for or breaking of or inhibiting of colloid systems (e.g., foam breaking, emulsion breaking, dispersion inhibiting, suspension settling, gel breaking, smoke suppressing, coagulating, flocculating), when generically claimed or when there is no hierarchically superior provision in the USPC for the specifically claimed art. Combinations of emulsion breaking and a treatment of the mineral oil provided for in Class 208 are classified in Class 208.

**179 Purifying used oil:**

This subclass is indented under subclass 177. Processes for treating used mineral oils to render them suitable for reuse.

- (1) Note. Many of the processes classified in this or indented subclasses are directed to the treatment of mineral oil dry cleaning solvents or lubricating oils.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 187, through 307, for similar processes of refining other mineral oils.

SEE OR SEARCH CLASS:

- 123, Internal-Combustion Engines, subclass 196 for purifiers contained in the lubricating systems peculiar to internal-combustion engines.
- 184, Lubrication, appropriate subclasses for lubricating systems that include a filter for the lubricating oil.
- 210, Liquid Purification or Separation, for liquid purification not otherwise provided for, see particularly subclasses 234+, 296 and 511 for the use of liquid as separating medium; subclasses 737, 766, and 774+ for process of separating including heating or cooling; and subclasses 175+ for separators combined with heaters or coolers.
- 516, Colloid Systems and Wetting Agents; Subcombinations Thereof; Processes of Making, Stabilizing, Breaking, or Inhibiting, subclasses 113+ for compositions for or subcombination compositions for or breaking of or inhibiting of colloid systems (e.g., foam breaking, emulsion breaking,

dispersion inhibiting, suspension settling, gel breaking, smoke suppressing, coagulating, flocculating), when generically claimed or when there is no hierarchically superior provision in the USPC for the specifically claimed art. Combinations of emulsion breaking and a treatment of the mineral oil provided for in Class 208 are classified in Class 208.

**180 With added organic material:**

This subclass is indented under subclass 179. Processes wherein an organic material is added to the used oil.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 237+, for processes of removing sulfur from an mineral oil (other than used oil) employing an added organic reagent.
- 290+, for other processes of purifying or refining mineral oil (other than used oil) by using organic reagents.

SEE OR SEARCH CLASS:

- 516, Colloid Systems and Wetting Agents; Subcombinations Thereof; Processes of Making, Stabilizing, Breaking, or Inhibiting, subclasses 113+ for compositions for or subcombination compositions for or breaking of or inhibiting of colloid systems (e.g., foam breaking, emulsion breaking, dispersion inhibiting, suspension settling, gel breaking, smoke suppressing, coagulating, flocculating), when generically claimed or when there is no hierarchically superior provision in the USPC for the specifically claimed art. Combinations of emulsion breaking and a treatment of the mineral oil provided for in Class 208 are classified in Class 208.

**181 Plural treating agents (sequential or simultaneous):**

This subclass is indented under subclass 179. Processes in which a plurality of inorganic materials are added to the used oil, either together or in sequence.

**SEE OR SEARCH CLASS:**

516, Colloid Systems and Wetting Agents; Subcombinations Thereof; Processes of Making, Stabilizing, Breaking, or Inhibiting, subclasses 113+ for compositions for or subcombination compositions for or breaking of or inhibiting of colloid systems (e.g., foam breaking, emulsion breaking, dispersion inhibiting, suspension settling, gel breaking, smoke suppressing, coagulating, flocculating), when generically claimed or when there is no hierarchically superior provision in the USPC for the specifically claimed art. Combinations of emulsion breaking and a treatment of the mineral oil provided for in Class 208 are classified in Class 208.

**182 One is a solid contact material:**

This subclass is indented under subclass 181. Processes wherein at least one of the treating agents is an adsorbent or filtering material.

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

299+, for processes of refining mineral oil (not used oil) wherein solid contact materials are used.

**SEE OR SEARCH CLASS:**

516, Colloid Systems and Wetting Agents; Subcombinations Thereof; Processes of Making, Stabilizing, Breaking, or Inhibiting, subclasses 113+ for compositions for or subcombination compositions for or breaking of or inhibiting of colloid systems (e.g., foam breaking, emulsion breaking, dispersion inhibiting, suspension settling, gel breaking, smoke suppressing, coagulating, flocculating), when generically claimed or when there is no hierarchically superior provision in the USPC for the specifically claimed art. Combinations of emulsion breaking and a treatment of the mineral oil provided for in Class 208 are classified in Class 208.

**183 With acid or alkali:**

This subclass is indented under subclass 182. Processes wherein, in addition to the solid contact material, an acid or an alkali metal, alkaline earth metal, magnesium or ammonium oxide, hydroxide or carbonate is employed.

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

219+, for processes of removing sulfur from raw mineral oil by use of acids.  
226+, for removing sulfur from raw mineral oil by use of alkali metal or alkaline earth metal compounds.  
265+, for processes of refining raw mineral oil by use of acids.  
283+, for processes of refining raw mineral oil by use of alkali metal or alkaline earth compounds.

**SEE OR SEARCH CLASS:**

516, Colloid Systems and Wetting Agents; Subcombinations Thereof; Processes of Making, Stabilizing, Breaking, or Inhibiting, subclasses 113+ for compositions for or subcombination compositions for or breaking of or inhibiting of colloid systems (e.g., foam breaking, emulsion breaking, dispersion inhibiting, suspension settling, gel breaking, smoke suppressing, coagulating, flocculating), when generically claimed or when there is no hierarchically superior provision in the USPC for the specifically claimed art. Combinations of emulsion breaking and a treatment of the mineral oil provided for in Class 208 are classified in Class 208.

**184 Distillation or degassing:**

This subclass is indented under subclass 179. Processes wherein the used oil is purified by distillation or a mechanical removal of gaseous material as by heating or use of reduced pressure.

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

347+, for processes of distilling mineral oils.

## SEE OR SEARCH CLASS:

- 202, Distillation: Apparatus, appropriate subclass for apparatus for distillation not otherwise provided for.
- 203, Distillation: Processes, Separatory, appropriate subclass, for a process of separatory distillation not otherwise provided for.
- 516, Colloid Systems and Wetting Agents; Subcombinations Thereof; Processes of Making, Stabilizing, Breaking, or Inhibiting, subclasses 113+ for compositions for or subcombination compositions for or breaking of or inhibiting of colloid systems (e.g., foam breaking, emulsion breaking, dispersion inhibiting, suspension settling, gel breaking, smoke suppressing, coagulating, flocculating), when generically claimed or when there is no hierarchically superior provision in the USPC for the specifically claimed art. Combinations of emulsion breaking and a treatment of the mineral oil provided for in Class 208 are classified in Class 208.

**185 With gaseous treating agent:**

This subclass is indented under subclass 184. Processes wherein distillation or degassing treatment is carried out in the presence of an added gaseous treating agent.

- (1) Note. Steam is an example of gaseous treating agents provided for herein.

## SEE OR SEARCH THIS CLASS, SUBCLASS:

- 356, and 362+, for similar processes of distilling raw mineral oils.

## SEE OR SEARCH CLASS:

- 516, Colloid Systems and Wetting Agents; Subcombinations Thereof; Processes of Making, Stabilizing, Breaking, or Inhibiting, subclasses 113+ for compositions for or subcombination compositions for or breaking of or inhibiting of colloid systems (e.g., foam breaking, emulsion breaking, dispersion inhibiting, suspension settling, gel breaking, smoke suppressing, coagulating, flocculating), when

generically claimed or when there is no hierarchically superior provision in the USPC for the specifically claimed art. Combinations of emulsion breaking and a treatment of the mineral oil provided for in Class 208 are classified in Class 208.

**186 With solid-liquid separation:**

This subclass is indented under subclass 184. Processes which include a specifically defined separation of liquid from solid material.

- (1) Note. Solid-liquid separation steps recited by name only are not included herein. Many of the processes classified in this subclass are directed to the separation of solid treating agents from the treated oil.

## SEE OR SEARCH CLASS:

- 516, Colloid Systems and Wetting Agents; Subcombinations Thereof; Processes of Making, Stabilizing, Breaking, or Inhibiting, subclasses 113+ for compositions for or subcombination compositions for or breaking of or inhibiting of colloid systems (e.g., foam breaking, emulsion breaking, dispersion inhibiting, suspension settling, gel breaking, smoke suppressing, coagulating, flocculating), when generically claimed or when there is no hierarchically superior provision in the USPC for the specifically claimed art. Combinations of emulsion breaking and a treatment of the mineral oil provided for in Class 208 are classified in Class 208.

**187 Water removal (dehydration):**

This subclass is indented under subclass 177. Processes for removing water from mineral oils.

- (1) Note. The water is generally present as entrained water although this and indented subclasses also provide for the separation of water emulsified with the oil wherein there is some treatment of the oil in addition to the breaking of the colloid system.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 24+, for processes of removing water from petroleum waxes.
- 39+, for processes of removing water from asphalts, tars, pitches or resins.
- 179+, for processes of removing water from used mineral oils.

SEE OR SEARCH CLASS:

- 210, Liquid Purification or Separation, appropriate subclass for processes of separating liquids from liquids not otherwise provided for. Processes and apparatus for separating water from a mineral oil including mere heating within a gravitational separator are classified in Class 210.
- 252, Compositions, subclasses 319+ and particularly subclasses 328+ for processes of resolving emulsions such as petroleum emulsions. Processes classified in Class 252, involve destroying the colloid system as distinct from removing water bound chemically and/or physically as by entrainment. If there is some treatment of the mineral oil in addition to the resolving step, the process is classified in this class (208).
- 516, Colloid Systems and Wetting Agents; Subcombinations Thereof; Processes of Making, Stabilizing, Breaking, or Inhibiting, subclasses 113+ for compositions for or subcombination compositions for or breaking of or inhibiting of colloid systems (e.g., foam breaking, emulsion breaking, dispersion inhibiting, suspension settling, gel breaking, smoke suppressing, coagulating, flocculating), when generically claimed or when there is no hierarchically superior provision in the USPC for the specifically claimed art. Processes classified in Class 516 involve destroying the colloid system as distinct from removing water bound chemically and/or physically as by entrainment. Combinations of emulsion breaking and a treatment of the mineral oil provided for in Class 208 are classified in Class 208.

#### 188 With treating agent:

This subclass is indented under subclass 187. Processes wherein a material is added to facilitate the removal of the water or resolution of the mineral oil-water system.

SEE OR SEARCH CLASS:

- 252, Compositions, subclass 194 for water-bindive compositions, per se.
- 516, Colloid Systems and Wetting Agents; Subcombinations Thereof; Processes of Making, Stabilizing, Breaking, or Inhibiting, subclasses 113+ for compositions for or subcombination compositions for or breaking of or inhibiting of colloid systems (e.g., foam breaking, emulsion breaking, dispersion inhibiting, suspension settling, gel breaking, smoke suppressing, coagulating, flocculating), when generically claimed or when there is no hierarchically superior provision in the USPC for the specifically claimed art. Combinations of emulsion breaking and a treatment of the mineral oil provided for in Class 208 are classified in Class 208.

#### 189 Sweetening:

This subclass is indented under subclass 177. Processes wherein a mineral oil is treated to convert mercaptans contained therein to disulfides.

- (1) Note. These processes are known as "Sweetening" treatments and result in an improvement of the color and odor of the mineral oil. Sweetening generally involves an oxidation treatment and the less noxious form of sulfur (disulfides) may or may not be removed from the mineral oil.
- (2) Note. Sweetening processes are classified herein even though carried out in the presence of an anti-oxidant. This process is known as "inhibitor sweetening". If the resulting sweetened oil is claimed and the inhibitor is not a mineral oil, the patent is classified as original in the appropriate composition class, e.g., those listed in the Search Notes below.

- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
208+, for processes of removing sulfur and sulfur containing compounds from mineral oil which do not involve the formation of the disulfide.
- SEE OR SEARCH CLASS:  
44, Fuel and Related Compositions, subclasses 300+ for mineral oil fuels including nonhydrocarbon additives (see (2) Note).  
252, Compositions, subclasses 182.11+, particularly subclasses 185 and 189+ for reagents employed in sweetening operations classified herein (in Class 208) (see (2) Note).  
508, Solid Anti-Friction Devices, Materials Therefor, Lubricant or Separant Compositions for Moving Solid Surfaces, and Miscellaneous Mineral Oil Compositions, particularly subclasses 110+ for mineral oil lubricating compositions including nonhydrocarbon additives.  
585, Chemistry of Hydrocarbon Compounds, subclasses 1+ for all-hydrocarbon compositions containing a nonmineral oil component.
- 190 With hypochlorites:**  
This subclass is indented under subclass 189. Processes wherein an added hypochlorite is employed.
- 191 With copper compounds:**  
This subclass is indented under subclass 189. Processes wherein an added copper compound is employed.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
246, for processes (nonsweetening) of removing sulfur using copper or a compound of copper.
- 192 With preliminary treatment of oil:**  
This subclass is indented under subclass 191. Processes combined with a nonconversion treatment of the mineral oil prior to the sweetening treatment with a copper compound.
- (1) Note. The preliminary treatment may, for example, include a removal of some other contaminant prior to the sweetening treatment.
- 193 With subsequent treatment of the sweet oil:**  
This subclass is indented under subclass 191. Processes wherein the sweetening treatment is combined with a subsequent nonconversion treatment of the sweetened oil.
- (1) Note. The subsequent treatment may include the removal of the disulfide sulfur formed during sweetening or some other contaminant from the sweetened oil.
- 194 Separation or recovery of copper compound:**  
This subclass is indented under subclass 193. Processes wherein the subsequent treatment includes a specifically defined procedure for separation and recovery of the copper containing sweetening agent from the sweetened oil.
- (1) Note. Recovery of the copper containing sweetening agent when recited by name only is not included as a subsequent treatment of the sweetened oil.
- 195 Copper chloride and free oxygen containing gas:**  
This subclass is indented under subclass 191. Processes wherein copper chloride and a free oxygen containing gas are employed.
- 196 With peroxides:**  
This subclass is indented under subclass 189. Processes wherein an added peroxide is employed.
- 197 With lead compounds:**  
This subclass is indented under subclass 189. Processes wherein an added lead compound is employed.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
249, for processes of removing sulfur using lead compound.

## SEE OR SEARCH CLASS:

252, Compositions, subclass 185 for compositions containing plumbiferous sulfur bindant agents which may be used in processes classified in this subclass (197).

**198 Lead sulfide:**

This subclass is indented under subclass 197. Processes wherein the treating agent comprises lead sulfide.

**199 Sodium plumbite:**

This subclass is indented under subclass 197. Processes wherein the treating agent comprises sodium plumbite.

**200 With preliminary treatment of the oil:**

This subclass is indented under subclass 199. Processes combined with a nonconversion treatment of the mineral oil prior to the sweetening treatment with sodium plumbite.

**201 With subsequent treatment of the sweet oil:**

This subclass is indented under subclass 199. Processes wherein the sweetening treatment is combined with a subsequent nonconversion treatment of the sweetened oil.

- (1) Note. The subsequent treatment may include the removal of the disulfide sulfur formed during sweetening or some other contaminant from the sweetened oil.

**202 Organic treating agent:**

This subclass is indented under subclass 201. Processes wherein the sweetened oil is subjected to treatment with an added organic material.

**203 With alkali metal hydroxide or carbonate:**

This subclass is indented under subclass 189. Processes wherein added alkali metal hydroxide or carbonate is employed.

- (1) Note. For the purpose of classification in this or indented subclass the alkali metals are Li, Na, K, Rb, Cs and Fr.
- (2) Note. This subclass contains, for example, sweetening processes wherein the treating agent may be sodium or potas-

sium hydroxide, carbonate or bicarbonate.

## SEE OR SEARCH THIS CLASS, SUBCLASS:

226, for processes (nonsweetening) of removing sulfur from mineral oil using alkali metal compounds.

**204 With added oxygen containing organic compound:**

This subclass is indented under subclass 203. Processes wherein an added oxygen containing organic compound is employed in addition to the alkali metal hydroxide or carbonate.

## SEE OR SEARCH THIS CLASS, SUBCLASS:

231, for processes of removing of sulfur employing an alkali metal compound and an oxygen containing organic compound.

**205 Acyclic alcohol:**

This subclass is indented under subclass 204. Processes wherein the organic oxygen compound is an acyclic alcohol, e.g., methanol, ethanol, or propanol.

## SEE OR SEARCH THIS CLASS, SUBCLASS:

232+, for processes of removing sulfur employing an alkali metal compound and an acyclic alcohol.

**206 With added nitrogen containing compound:**

This subclass is indented under subclass 203. Processes wherein an added nitrogen containing compound is employed in addition to the alkali metal hydroxide or carbonate.

## SEE OR SEARCH THIS CLASS, SUBCLASS:

205, for sweetening processes using alkanol amines in combination with alkali metal hydroxides and carbonates.

207, for sweetening processes using nitrogen containing treating agents.

**207 Nitrogen containing compound:**

This subclass is indented under subclass 189. Processes wherein an added nitrogen containing compound is employed.

- SEE OR SEARCH THIS CLASS, SUB-CLASS:
- 206, for sweetening processes wherein nitrogen containing treating agents are used in combination with an alkali metal hydroxide or carbonate.
- 236, for processes of removing sulfur from mineral oils using nitrogen containing treating agents.
- 208 Sulfur removal (free or combined sulfur):**  
This subclass is indented under subclass 177. Processes wherein mineral oil is treated to remove sulfur therefrom, whether present as free sulfur or as a compound.
- (1) Note. Processes classifiable in this or indented subclass are those wherein (1) the claims specify the removal of sulfur or (2) the disclosure is limited to the removal of sulfur. See (2) Note to subclass 177.
- 209 With hydrogen:**  
This subclass is indented under subclass 208. Processes wherein the mineral oil is desulfurized in the presence of added hydrogen.
- (1) Note. The hydrogen may be added as a free gas or a hydrogen rich material may be used under such conditions as to generate or liberate hydrogen (hydrogen donor processes).
- SEE OR SEARCH THIS CLASS, SUB-CLASS:
- 58+, and 107+, for hydrocracking processes wherein sulfur may also be removed. Thus, if the hydrodesulfurization is carried out under conditions which will promote chemical conversion of the oil, the process will be classified as a chemical conversion rather than as a refining treatment.
- 89, for processes of refining mineral oils with added hydrogen combined with a subsequent chemical conversion of the refined oil.
- 210 Plural stage treatments with hydrogen:**  
This subclass is indented under subclass 209. Processes which include desulfurization of mineral oil in the presence of hydrogen in each of a plurality of steps or stages.
- 211 With preliminary treatment of feed:**  
This subclass is indented under subclass 209. Processes combined with a nonconversion treatment of the mineral oil prior to the hydrodesulfurization treatment.
- (1) Note. The preliminary treatment may, for example, include removal of sulfur (other than by using hydrogen) or other type of refining.
- 212 With subsequent treatment of product:**  
This subclass is indented under subclass 209. Processes wherein the hydrodesulfurizing treatment is combined with a subsequent nonconversion treatment of the desulfurized oil.
- (1) Note. The subsequent treatment may include further refining (removal of sulfur other than by use of hydrogen or removal of other impurities) or any other subsequent nonconversion type treatment.
- SEE OR SEARCH CLASS:
- 44, Fuel and Related Compositions, subclasses 300+, for a process of desulfurizing a mineral oil fuel and adding a stabilizer to the product.
- 213 With solid catalyst or adsorbent:**  
This subclass is indented under subclass 209. Processes wherein the hydrodesulfurization takes place in the presence of a solid catalyst or adsorbent.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:
- 299+, for other refining processes carried out in the presence of a solid catalyst or adsorbent.
- 214 With hydrogen yielding material (H donor):**  
This subclass is indented under subclass 213. Processes wherein an added hydrogen rich material is employed under conditions that

hydrogen is generated or liberated during the process (hydrogen donor processes).

SEE OR SEARCH THIS CLASS, SUB-CLASS:

56, and 145, for mineral oil conversion processes wherein hydrogen donor agents are used as sources of hydrogen.

**215 With heavy metal sulfide:**

This subclass is indented under subclass 213. Processes wherein the solid catalyst or adsorbent is a sulfide of a heavy metal.

(1) Note. A heavy metal is one which has a specific gravity greater than 4 and includes all metals except alkali, alkaline earth, magnesium and aluminum.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

293, for other refining processes wherein the treating agent contains sulfur.

**216 With group VI metal or compound:**

This subclass is indented under subclass 213. Processes wherein the solid catalyst or adsorbent comprises, a Group VI metal, (Cr, Mo, W or Po) or compound, thereof.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

243, and 295, for other refining processes wherein Group VI metals or compounds thereof are used.

**217 With Group VIII metal or compound:**

This subclass is indented under subclass 213. Processes wherein the solid catalyst or adsorbent comprises a Group VIII metal (Fe, Co, Ni, Ru, Rh, Pd, Os, Ir or Pt) or compound thereof.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

244, and 295, for other refining processes wherein Group VIII metals or compounds thereof are used.

**218 Split treatment:**

This subclass is indented under subclass 208. Processes wherein a mineral oil is divided into several fractions, at least one of which is

treated to remove sulfur therefrom and then the separate fractions are reblended.

(1) Note. Processes wherein mineral oil is fractionated and then at least one fraction is desulfurized, there being no reblending of the fractions, are classified in the appropriate subclass providing for desulfurizing combined with a preliminary treatment of the oil.

**219 With acids:**

This subclass is indented under subclass 208. Processes wherein sulfur is removed from mineral oil by the use of an acid.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

90, for processes including acid refining of mineral oils combined with chemical conversion of the refined oil.

98, for processes of converting mineral oils followed by refining the converted products with acid.

252, for processes of removing metal contaminants from mineral oils with acids.

256, for processes of removing gums or gum formers from mineral oils with acids.

265+, for other processes of refining of mineral oils with acids.

**220 Plural stages of sulfur removal:**

This subclass is indented under subclass 219. Processes which include desulfurization of mineral oil in plural stages, at least one of which includes the use of an acid.

**221 With preliminary treatment of feed:**

This subclass is indented under subclass 219. Processes combined with a nonconversion treatment of the mineral oil prior to the acid desulfurization.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

220, for processes involving removal of sulfur from oil in plural stages, at least one of which is acid desulfurization.

**222 With subsequent treatment of product:**

This subclass is indented under subclass 219. Processes wherein the desulfurizing treatment is combined with a nonconversion treatment of the desulfurized oil.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

220, for processes wherein sulfur is removed from oil in plural stages, at least one of which is acid desulfurization.

**223 Inorganic acid:**

This subclass is indented under subclass 219. Processes wherein an inorganic acid is employed.

**224 Sulfuric acid:**

This subclass is indented under subclass 223. Processes wherein sulfuric acid is employed.

**225 Hydrochloric acid:**

This subclass is indented under subclass 223. Processes wherein hydrochloric acid is employed.

**226 With alkali or alkali earth metal compound (except clays):**

This subclass is indented under subclass 208. Processes wherein mineral oil is desulfurized by the use of an alkali or alkaline earth metal compound.

(1) Note. For the purpose of this classification, the alkali metals are sodium, potassium, lithium, rubidium, cesium and francium and the alkaline earth metals are calcium, barium, and strontium and also including magnesium.

(2) Note. Natural clays which generally contain some alkali metal component are not included in this or indented subclasses but are classified instead with the aluminum or silicon containing compounds.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

203+, for processes of sweetening mineral oils with alkali metal hydroxides or carbonates.

258, and 259, for processes of removing gums or gum formers from mineral oils with free alkali metals and alkali and alkaline earth metal compounds, respectively.

283+, for other processes for refining of mineral oils with alkali or alkaline earth metal compounds.

**227 Plural stages of sulfur removal:**

This subclass is indented under subclass 226. Processes which include desulfurization of mineral oil in plural stages at least one of which is in the presence of an added alkali or alkaline earth metal compound.

**228 With preliminary treatment of feed:**

This subclass is indented under subclass 226. Processes combined with a nonconversion treatment of the mineral oil prior to the desulfurization with the alkali or alkaline earth metal compound.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

227, for processes including removal of sulfur from oil in a plurality of stages, alkali or alkaline earth metal being employed in one stage.

**229 With subsequent treatment of product:**

This subclass is indented under subclass 226. Processes wherein the desulfurizing treatment is combined with a subsequent nonconversion treatment of the desulfurized oil.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

227, for processes including removal of sulfur from oil in a plurality of stages, alkali or alkaline earth metal being employed in one stage.

**230 Alkali metal compound:**

This subclass is indented under subclass 226. Processes wherein an alkali metal compound is employed.

**231 With added oxygen containing organic compound:**

This subclass is indented under subclass 230. Processes wherein an oxygen containing organic compound is employed in addition of the alkali metal compound.

- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
204, for mineral oil sweetening processes wherein an alkali metal hydroxide or carbonate is employed with an oxygen containing organic compound.
- 232 Alcohol containing:**  
This subclass is indented under subclass 231. Processes wherein an added alcohol is employed.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
205, for sweetening treatments wherein an alkali metal hydroxide or carbonate and an acyclic alcohol are used.
- 233 With other organic compound:**  
This subclass is indented under subclass 232. Processes wherein there is also employed an organic compound in addition to an alcohol and an alkali metal compound.
- 234 With regeneration of treating agent:**  
This subclass is indented under subclass 231. Processes combined with the treatment of the alkali metal compound and/or oxygen organic compound employed for desulfurizing to restore it to the original condition or to condition for reuse.
- SEE OR SEARCH CLASS:  
502, Catalyst, Solid Sorbent, or Support Therefor: Product or Process of Making, for a composition comprising a catalyst or sorbent, per se, and see especially subclasses 20+ for a process of regenerating a catalyst or sorbent.
- 235 With regeneration of treating agent:**  
This subclass is indented under subclass 230. Processes combined with the treatment of the alkali metal compound employed for desulfurization to restore it to the original condition or to condition for reuse.
- SEE OR SEARCH CLASS:  
502, Catalyst, Solid Sorbent, or Support Therefor: Product or Process of Making, for a composition comprising a catalyst or sorbent, per se, and see especially subclasses 20+ for a process of regenerating a catalyst or sorbent.
- 236 With nitrogen containing treating reagent:**  
This subclass is indented under subclass 208. Processes wherein mineral oil is desulfurized by use of a nitrogen containing compound.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
206, and 207, for sweetening treatments employing nitrogen containing treating agents.  
232, for desulfurization processes wherein alkanol amines are used in combination with alkali metal compounds.
- 237 With organic reagent:**  
This subclass is indented under subclass 208. Processes wherein mineral oil is desulfurized by the use of an added organic compound.
- 238 Hydrocarbon containing:**  
This subclass is indented under subclass 237. Processes wherein a hydrocarbon is employed.
- 239 Heavy metal soap containing:**  
This subclass is indented under subclass 237. Processes wherein a heavy metal soap (heavy metal salts of higher fatty acid or naphthenic acid) is employed.
- 240 Oxygen containing:**  
This subclass is indented under subclass 237. Processes wherein an oxygen containing organic compound is employed.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
204+, for sweetening processes employing oxygen containing organic compounds in combination with an alkali metal hydroxide or carbonate.  
231+, for desulfurization processes using oxygen containing organic compounds in combination with an alkali metal compound.

- 239, for processes of desulfurization with heavy metal soaps.
- 241 With free halogen or nonmetal halide containing reagent:**  
This subclass is indented under subclass 208. Processes wherein a mineral oil is desulfurized by the use of a free halogen or a halide of a nonmetal.
- (1) Note. Boron halides and sulfur halides are examples of reagents employed in processes classified in this subclass.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
219+, for desulfurizing processes wherein a halogen acid is employed.
- 242 With sulfur oxides:**  
This subclass is indented under subclass 208. Processes wherein a mineral oil is desulfurized by the use of added oxide of sulfur.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
219+, for desulfurizing processes wherein a sulfur containing acid is employed.  
338, for processes of fractionating mineral oil by extracting with liquid sulfur dioxide.
- 243 With Group VI metal or compound:**  
This subclass is indented under subclass 208. Processes wherein mineral oil is desulfurized by use of a Group VI metal (Cr, Mo, W or Po) or compound thereof.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
216, for hydrodesulfurization processes wherein a Group VI metal or compound thereof is used.  
295, for other processes of refining using Group VI metal compounds.
- 244 With Group VIII metal or compound:**  
This subclass is indented under subclass 208. Processes wherein mineral oil is desulfurized by use of a Group VIII metal (Fe, Co, Ni, Ru, Rh, Pd, Os, Ir or Pt) or compound thereof.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
217, for hydrodesulfurization methods wherein a Group VIII metal or compound thereof is used.  
295, for other processes of refining wherein Group VIII compounds are used.
- 245 With silicon or compound thereof:**  
This subclass is indented under subclass 208. Processes wherein mineral oil is desulfurized by the use of silicon or a compound thereof.
- (1) Note. This subclass contains, for example, desulfurization processes wherein silicon oxides, per se, or combined as silicates (e.g., clays) are used.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
250, for manipulative processes of desulfurizing mineral oils using unnamed solid contact agents, but which may be disclosed as being the clay type.  
299+, for other processes of refining mineral oils by treating the same with solid contact agents, and particularly subclass 307 for the use of silicon containing treating agents, e.g., clay, in such processes.
- 246 With Group IB metal or compound:**  
This subclass is indented under subclass 208. Processes wherein mineral oil is desulfurized by the use of a Group IB metal (Cu, Ag or Au) or compound thereof.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
296, for other processes of refining wherein Group IB metal compounds are used.
- 247 With Group IIB metal or compound:**  
This subclass is indented under subclass 208. Processes wherein mineral oil is desulfurized by the use of a Group IIB metal (Zn, Cd or Hg) or compound thereof.

- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
296, for other processes of refining wherein Group IIB metal compounds are used.
- 248 With Group III metal or compound:**  
This subclass is indented under subclass 208. Processes wherein mineral oil is desulfurized by use of a Group III metal (Al, Ga, In, Tl, Sc, Y, a rare earth or actinide series metal) or compound thereof.
- (1) Note. When carriers such as alumina are used with a metal or oxide thereof as distinct compounds or combined as a complex compound, e.g., aluminum molybdate, the original patent is classified with the metal provided for first in the schedule.
- 249 With Group IV, V, VII metal or compound:**  
This subclass is indented under subclass 208. Processes wherein the treating agent comprises a Group IV, V, VII metal (Ti, Zr, Hf, V, Nb, Ta, Mn, Tc, Re, Ge, Sn, Pb, As, Sb or Bi) or compounds thereof.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
292, for other refining processes employing arsenic, antimony or bismuth containing agents.  
295, for other refining processes wherein Group IV, V or VII metal compounds are used.
- 250 Solids contacting and mixing:**  
This subclass is indented under subclass 208. Processes for desulfurizing mineral oil by contacting the oil with solid contact agents.
- (1) Note. This subclass is the collecting place for manipulate techniques of desulfurization with solid contacting agents claimed broadly and not limited to any specific type of treating agent provided or above. If the specific type of treating agent provided for above is set forth in a claim as well as the manipulative technique, the patent is classified above with the treating agent and cross-referenced herein.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
146+, for processes of converting mineral oils by contacting with solids.  
299+, for other refining processes involving manipulative techniques of contacting mineral oils with solid catalysts or adsorbents.
- 251 Metal contaminant removal:**  
This subclass is indented under subclass 177. Processes wherein a mineral oil is treated to remove a metal or metal compound therefrom.
- (1) Note. The metals or compounds thereof are contaminants which may have an effect of poisoning or rendering less active solid catalyst treating agents, e.g., platinum catalysts, and removal is necessary to prevent such effects.  
(2) Note. Processes classified in this or indented subclasses are those wherein (1) the claims specify the removal of metal or metal compound or (2) the disclosure is limited to the removal of the metal or metal compound. See (2) Note to subclass 177.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
88+, for processes of removing metal contaminants from mineral oils combined with subsequent conversion of the refined oil whereby poisoning of the catalyst is prevented.
- 252 With acid:**  
This subclass is indented under subclass 251. Processes wherein an acid is employed.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
90, for processes of acid refining of mineral oil combined with subsequent chemical conversion.  
98, for processes of chemical conversion of mineral oil combined with acid refining a product thereof.  
219+, for processes of desulfurization of mineral oils with acids.  
256, for processes removing gum or gum formers with acids.

265+, for other processes of refining of mineral oils with acids.

**253 With metal or metal compound:**

This subclass is indented under subclass 251. Processes wherein an added metal or a metal compound is employed.

SEE OR SEARCH THIS CLASS, SUBCLASS:

257+, for processes of removing gums or gum formers using metals or metal compounds.

283+, for other refining processes using alkali or alkaline earth metal compounds.

294, for other refining processes using a free metal as the treating agent.

295, through 297, for other refining processes wherein metal compounds are used.

**254 Nitrogen contaminant removal:**

This subclass is indented under subclass 177. Processes wherein a mineral oil is treated to remove nitrogen containing materials therefrom.

- (1) Note. Processes classified in this subclass are those in which (1) the claims specify the removal of nitrogen containing materials or (2) those in which the disclosure is limited to the removal of such materials. See (2) Note to subclass 177.

**255 Gum or gum former removal:**

This subclass is indented under subclass 177. Processes wherein a mineral oil is treated to remove monoolefinic or polyolefinic components (gums or gum forming materials) therefrom.

- (1) Note. The olefinic compounds polymerize into gums and both the resulting gum or the gum former, per se, constitute an undesirable component of the oil.
- (2) Note. Processes classified in this or indented subclass are those in which (1) the claims specify the removal of gums or gum formers or (2) the disclosure is limited to the removal of such materials. See (2) Note to subclass 177.

SEE OR SEARCH CLASS:

507, Earth Boring, Well Treating, and Oil Field Chemistry, subclass 90 for compositions for preventing the formation of deposits in conduits carrying petroleum and processes involving the mere use of such compositions.

**256 With acid:**

This subclass is indented under subclass 255. Processes wherein an acid is employed.

SEE OR SEARCH THIS CLASS, SUBCLASS:

90, for processes of acid refining of mineral oil combined with a subsequent chemical conversion.

98, for processes of chemical conversion of a mineral oil combined with acid refining a product thereof.

219+, for processes of desulfurization of mineral oils with acids.

252, for processes of removing metallic contaminants with acids.

265+, for other processes of refining of mineral oils with acids.

**257 With metal or metal compound:**

This subclass is indented under subclass 255. Processes wherein a metal or a metal compound is employed.

SEE OR SEARCH THIS CLASS, SUBCLASS:

253, for processes of removing metal contaminants wherein a metal or metal compound is employed.

283+, for other refining processes wherein an alkali or alkaline earth metal compound is employed.

294, for other refining processes wherein a free metal is employed.

295, through 297, for other processes of refining wherein metal compounds are employed.

**258 Alkali metal:**

This subclass is indented under subclass 257. Processes wherein elemental alkali metal is employed.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

294, for other refining processes using an elemental alkali metal.

**259 Alkali or alkali earth metal compound (except clays):**

This subclass is indented under subclass 257. Processes wherein an alkali or alkaline earth metal compound is employed.

- (1) Note. The "alkali metals" are lithium, sodium, potassium, rubidium, cesium and francium, and "alkaline earth metals" are calcium, barium, strontium and also includes magnesium.
- (2) Note. Natural clays which generally contain some alkali metal component are not included in this subclass but are classified with the aluminum or silicon compounds.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

260+, for processes of removing gums or gum formers wherein natural clays or alumina are used as the treating agents.

283+, for general refining processes wherein alkali or alkaline earth metal compounds are used as the treating agents.

**260 Clay type or alumina:**

This subclass is indented under subclass 257. Processes wherein aluminum oxide or a natural clay is employed.

- (1) Note. This subclass contains, for example, manipulative processes of removing gums and gum formers by polymerizing the olefinic constituents using solid contact agents such as alumina or natural clays as the catalyst and then removing the polymer formed from the oil.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

245, for processes of desulfurizing mineral oils using a silicon containing treating agent.

248, for processes of desulfurizing mineral oils using aluminum or a compound thereof as the treating agent.

250, for other desulfurizing processes wherein solid contacting agents are used.

297, for other refining processes involving contacting mineral oil with a solid contact agent (catalyst or adsorbent).

299+, for other refining processes involving contacting the mineral oil with solid contact agent (catalyst or adsorbent).

**261 Vapor phase treatment:**

This subclass is indented under subclass 260. Processes wherein the oil is in the vapor state when contacted with the clay or alumina.

**262.1 Halogen contaminant removal:**

This subclass is indented under subclass 177. Processes for removing undesirable halogen containing components from mineral oils.

- (1) Note. Processes classified herein are those in which (a) the claims specify the removal of halogen containing materials or (b) the disclosure is limited to the removal of such materials. See (2) Note to subclass 177.

**262.5 Polychlorinated biphenyl (PCB):**

This subclass is indented under subclass 262.1. Process wherein the contaminant removed is a polychlorinated biphenyl.

**263 Organic acid or phenol contaminant removal:**

This subclass is indented under subclass 177. Processes for removing undesirable organic acids or phenolic components from mineral oils.

- (1) Note. Organic acids such as fatty and naphthenic acids tend to form soaps during refining and these soaps form undesirable emulsions, hence the necessity for removing the same from the oil. Also some of these acidic materials tend to cause the oil to be corrosive unless removed.
- (2) Note. Processes classified in this subclass are those in which (1) the claims specify the removal of organic acid or

phenol components or (2) the disclosure is limited to the removal of such components.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

47, for processes including a conversion of a mineral oil combined with some step to prevent corrosion or erosion of the apparatus employed.

SEE OR SEARCH CLASS:

516, Colloid Systems and Wetting Agents; Subcombinations Thereof; Processes of Making, Stabilizing, Breaking, or Inhibiting, subclasses 113+ for compositions for or subcombination compositions for or breaking of or inhibiting of colloid systems (e.g., foam breaking, emulsion breaking, dispersion inhibiting, suspension settling, gel breaking, smoke suppressing, coagulating, flocculating), when generically claimed or when there is no hierarchically superior provision in the USPC for the specifically claimed art. Combinations of emulsion breaking and a treatment of the mineral oil provided for in Class 208 are classified in Class 208.

**264 With hydrogen:**

This subclass is indented under subclass 177. Processes wherein the mineral oil is treated with added hydrogen.

(1) Note. The hydrogen may be added as a free gas or a hydrogen rich material may be used under such conditions as to generate or liberate hydrogen (hydrogen donor processes).

SEE OR SEARCH THIS CLASS, SUB-CLASS:

89, for processes of refining mineral oil with hydrogen combined with chemical conversion of the oil.

209+, for processes of desulfurizing mineral oils wherein hydrogen is used.

**265 With acids:**

This subclass is indented under subclass 177. Processes wherein mineral oil is treated with an added acid.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

90, for processes of acid refining mineral oil combined with a subsequent chemical conversion.

98, for processes of chemical conversion of a mineral oil combined with acid refining a product thereof.

219+, for processes of desulfurizing mineral oils with acids.

252, for processes of removing metal contaminants with acids.

256, for processes of removing gums or gum formers with acids.

**266 Sulfuric acid:**

This subclass is indented under subclass 265. Processes wherein sulfuric acid is employed.

(1) Note. Sulfuric acid treatment of mineral oils results in oils of improved odor, color, color stability, stability to heat and oxidation and resistance to sludge formation.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

224, for processes of desulfurizing mineral oil with sulfuric acid.

**267 With fluid rotation or agitation:**

This subclass is indented under subclass 266. Processes involving mixing the acid with the mineral oil by some particular procedure of agitating or fluid rotation which is recited other than by name only.

**268 White oil making:**

This subclass is indented under subclass 266. Processes for preparing highly refined or medicinal oils known as "white" oils.

(1) Note. The treatment removes organic impurities resulting in an oil of improved odor and color suitable for pharmaceutical or medicinal purposes.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

263, for processes for the treatment of mineral oil to remove organic acids or phenolic impurities.

**269 Split treatment:**

This subclass is indented under subclass 266. Processes wherein mineral oil is separated into two or more fractions at least one of which is subjected to a sulfuric acid refining treatment combined with reblending of the mineral oil fractions.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

218, for processes of desulfurization of mineral oils including separating the oil into fractions at least one of which is treated to remove sulfur.

272, for processes whereby mineral oil is fractionated and then at least one fraction is subjected to a sulfuric acid refining treatment, there being no reblending of the fractions.

**270 Plural stages of acid treatment:**

This subclass is indented under subclass 266. Processes wherein mineral oil is subjected to a plurality of distinct refining treatments with acid, sulfuric acid being employed in at least one of the treatments.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

220, for processes including plural stages of desulfurization, at least one of the treatments being with an acid.

**271 With preliminary treatment of the oil:**

This subclass is indented under subclass 266. Processes combined with a nonconversion treatment of the mineral oil prior to the sulfuric acid refining.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

221, for processes of acid desulfurizing a mineral oil combined with a treatment of the oil prior to desulfurizing.

269, for processes of fractionating the oil, sulfuric acid refining at least one fraction and then reblending the fractions ("split treatment").

**272 Fractionation:**

This subclass is indented under subclass 271. Processes wherein the mineral oil is subjected to a fractionation prior to sulfuric acid refining.

(1) Note. The fractionation may be carried out by distillation, solvent extraction, etc.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

269, for processes including preliminary fractionation combined with reblending, known as "split feed" treatments.

**273 With subsequent treatment of the oil:**

This subclass is indented under subclass 266. Processes wherein the acid treatment is combined with a subsequent nonconversion treatment of the sulfuric acid refined oil.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

222, for processes of acid desulfurizing a mineral oil combined with the treatment of the desulfurized oil.

**274 Organic treating agent:**

This subclass is indented under subclass 273. Processes wherein the sulfuric acid refined oil is subsequently treated with an added organic compound.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

237+, for processes of desulfurizing mineral oils with organic compounds.

290+, for processes of refining mineral oil in which an added organic material is employed.

**275 Solid absorbent:**

This subclass is indented under subclass 273. Processes wherein the sulfuric acid refined oil is subsequently treated with a solid adsorbent.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

250, for processes, particularly manipulative techniques of contacting mineral oils with solid adsorbents in a desulfurization treatment of the oils.

299+, for processes, particularly manipulative techniques of contacting mineral oils with solid contact treating agents in refining processes.

- 276 With nonwater additive:**  
This subclass is indented under subclass 266. Processes in which an added material, other than water, is used along with the sulfuric acid.
- 277 Organic compound:**  
This subclass is indented under subclass 276. Processes wherein an added organic compound is employed.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
290+, for processes of refining mineral oil in which an added organic compound is employed.
- 278 Solid contact material:**  
This subclass is indented under subclass 276. Processes wherein a solid material, e.g., a carrier for the acid, is employed.
- (1) Note. The added material must remain in the solid state during the refining operation.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
299+, for processes of refining mineral oil by use of solid contact material, generally involving some manipulative solid-liquid contact procedure.
- 279 Phosphorus containing acid:**  
This subclass is indented under subclass 265. Processes wherein a phosphorus containing acid is employed.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
292, for other refining processes wherein phosphorus containing materials such as phosphoric anhydride are used.
- 280 Halogen containing acid:**  
This subclass is indented under subclass 265. Processes wherein a halogen containing acid is employed.
- (1) Note. This subclass contains, for example, processes of refining mineral oils with hydrofluoric acid.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
241, for processes of desulfurizing mineral oils wherein nonmetal halide treating agents are used.
- 281 Hydrochloric acid:**  
This subclass is indented under subclass 280. Processes wherein an hydrochloric acid is employed.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
225, for processes of desulfurizing mineral oil with hydrochloric acid.
- 282 Organic acid:**  
This subclass is indented under subclass 265. Processes wherein an organic acid is employed.
- (1) Note. This subclass contains, for example, processes of treating mineral oils with lower aliphatic acids, naphthenic acid, salicylic acid, et.
- 283 With alkali or alkali earth metal compound (except clays):**  
This subclass is indented under subclass 177. Processes wherein mineral oil is treated with an alkali or alkaline earth metal compound.
- (1) Note. For the purpose of this classification, the alkali metals are sodium, potassium, lithium, rubidium, cesium and francium and the alkaline earth metals are calcium, barium and strontium and also including magnesium.
- (2) Note. Natural clays which generally contain some alkali metal component are not included in this or indented subclasses but are classified instead with the aluminum or silicon containing compounds.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
203+, for processes of sweetening using alkali metal hydroxides and carbonates.  
226+, for processes of desulfurizing mineral oils with alkali or alkaline earth metal compounds.

- 259, for processes of removing gums or gum formers with alkali or alkaline earth metal compounds.
- 284 Alkali metal compound:**  
This subclass is indented under subclass 283. Processes wherein an alkali metal compound is employed.
- 285 With preliminary treatment of the oil:**  
This subclass is indented under subclass 284. Processes combined with a nonconversion treatment of the mineral oil prior to the treatment with the alkali metal compound.
- 286 With subsequent treatment of the oil:**  
This subclass is indented under subclass 284. Processes combine with a nonconversion treatment of the mineral oil subsequent to the treatment with the alkali metal compound.
- 287 With solid carrier:**  
This subclass is indented under subclass 284. Processes wherein a solid on which the alkali metal compound is supported is employed.
- (1) Note. The solid carriers may be clay, alumina, carbon, etc., and must remain in the solid state during the refining operation.
- 288 With added material:**  
This subclass is indented under subclass 284. Processes in which an added material, other than water, is combined with the alkali metal compound.
- 289 With nitrogen containing compound:**  
This subclass is indented under subclass 177. Processes wherein mineral oil is treated with an added nitrogen containing compound.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
- 206, for processes of sweetening mineral oils with nitrogen containing compounds in combination with an alkali metal hydroxide or carbonate.
- 207, for processes of sweetening mineral oils with nitrogen containing treating agents.
- 236, for processes of desulfurizing mineral oils with nitrogen containing treating agents.
- 290 With organic compound:**  
This subclass is indented under subclass 177. Processes wherein mineral oil is treated with an added organic compound.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
- 237+, for processes of desulfurizing mineral oils with organic compounds.
- 282, for refining processes wherein organic acids are used.
- 291 Oxygen containing:**  
This subclass is indented under subclass 290. Processes wherein an organic compound containing oxygen is employed.
- 292 With boron, phosphorus, arsenic, antimony or bismuth containing treating agent:**  
This subclass is indented under subclass 177. Processes wherein mineral oil is treated with boron, phosphorus, arsenic, antimony or bismuth or a compound thereof.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
- 249, for processes of desulfurizing mineral oils with a Group V metal or compound thereof.
- 279, for processes of refining mineral oils with phosphorus containing acids.
- 290+, for refining processes wherein organic compounds of boron, phosphorus, arsenic, antimony or bismuth are used.
- 293 With sulfur containing treating agent:**  
This subclass is indented under subclass 177. Processes wherein mineral oil is treated with an added sulfur containing material.
- (1) Note. Metal sulfates and sulfides and the various sulfur oxides are examples of treating agents used in the processes classified herein.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
- 242, for processes of desulfurizing mineral oils using sulfur oxides.

**294 With free metal:**

This subclass is indented under subclass 177. Processes wherein mineral oil is treated with an elemental metal.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 253, for processes of removing metal contaminants by employing elemental metal.
- 258, for processes of removing gums or gum formers with an elemental alkali metal.
- 292, for refining processes wherein elemental arsenic, antimony or bismuth is used.

**295 With Group IV, V, VI, VII or VIII metal compound:**

This subclass is indented under subclass 177. Processes wherein mineral oil is treated with a compound of a metal of Groups IV, V, VI, VII or VIII.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 216, 217, 243, 244, and 249, for processes of desulfurizing mineral oils using Groups IV, V, VI, VII or VIII metal compounds.
- 292, for processes of refining employing arsenic, antimony or bismuth containing treating agent.
- 299+, for refining processes, particularly those involving manipulative techniques, of contacting mineral oils with solid catalysts or adsorbents.

**296 With Group IB or IIB metal compound:**

This subclass is indented under subclass 177. Processes wherein mineral oil is treated with a compound of a metal of Groups IB, or IIB, i.e., Cu, Ag, Au, Zn, Cd or Hg.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 246, for processes of desulfurizing mineral oils with Group IB metal compounds.
- 247, for processes of desulfurizing mineral oils with Group IIB metal compounds.

**297 With Group III metal compound (except clays):**

This subclass is indented under subclass 177. Processes wherein mineral oil is treated with a Group III metal compound, excluding those processes in which the oily such compound is clay.

- (1) Note. Included in Group III metals are Al, Ga, In, Tl, Sc, Y, rare earth and actinide series metals.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 248, for processes of desulfurizing mineral oils using Group III metal compounds.

**298 With liquid treating agent (includes slurries of solids):**

This subclass is indented under subclass 177. Processes involving contacting mineral oil with liquid treating agents not provided for above.

- (1) Note. Slurries of solids are included herein as liquid treating agents when handled as a liquid.
- (2) Note. This subclass is the collecting place for manipulative techniques for refining mineral oil with liquid treating agents claimed broadly, or treating agents not provided for above. Processes involving some manipulative technique and also specifying the use of a treating agent provided for above are cross referenced to this subclass if necessary.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 339, for solvent fractionation of mineral oils involving some particular liquid to liquid contacting procedure.

**299 With solid catalyst or absorbent:**

This subclass is indented under subclass 177. Processes involving contacting mineral oil with a solid catalyst or adsorbent not provided for above.

- (1) Note. This and indented subclasses are the collecting places for manipulative techniques for refining mineral oil with a

solid catalyst or adsorbent which is either unidentified, or is not provided for above. Processes which involve some manipulative technique and also specify a solid provided for above are cross referenced to this or indented subclass if necessary.

SEE OR SEARCH THIS CLASS, SUBCLASS:

146+, for processes including manipulative techniques of contacting mineral oils with solid catalysts or heat carriers during the chemical conversion of the oil.

250, for processes of contacting mineral oil with solids in the desulfurizing of mineral oils.

298, for mineral oil refining processes involving contacting the oil with a slurry of solids handled as a liquid.

**300 Of particular physical shape or structure:**

This subclass is indented under subclass 299. Processes wherein a solid treating agent having some structural characteristic particularly adapting it for refining mineral oil is employed.

(1) Note. Examples of structural characteristics which are regarded as peculiar to the use of the solid for refining are size, shape and degree of porosity.

**301 With preliminary treatment of the oil:**

This subclass is indented under subclass 299. Processes combined with a nonconversion treatment of the mineral oil prior to the contacting with the solid catalyst or adsorbent.

**302 With subsequent treatment of the oil:**

This subclass is indented under subclass 299. Processes combined with a nonconversion treatment of the mineral oil subsequent to the contacting of the oil with the solid catalyst or adsorbent.

**303 Plural treating stages:**

This subclass is indented under subclass 299. Processes wherein mineral oil is subjected to a plurality of distinct refining treatments, solid catalyst or adsorbent being employed in each of the treatments.

**304 Processes including downward movement of particles:**

This subclass is indented under subclass 299. Processes wherein the solid catalyst or adsorbent move downwardly in a contacting chamber.

(1) Note. The solids may flow downwardly as a gravitating compact bed or as freely falling bodies.

SEE OR SEARCH THIS CLASS, SUBCLASS:

165+, for mineral oil conversion processes in which the oil is contacted with a downwardly moving compact bed of solids.

176, for mineral oil conversion process in which the oil is contacted with solids moving downwardly other than as a gravitating compact bed, and other than in suspension.

**305 Solids rehabilitation:**

This subclass is indented under subclass 299. Processes combined with a treatment to restore the activity of the solid catalyst or adsorbent to the original condition or to condition for reuse.

SEE OR SEARCH CLASS:

210, Liquid Purification or Separation, subclasses 670+ for processes of purifying a liquid by ion exchange or sorption combined with regenerating the agents used.

502, Catalyst, Solid Sorbent, or Support Therefor: Product or Process of Making, for a composition comprising a catalyst or sorbent, per se, and see especially subclasses 20+ for a process of regenerating a catalyst or sorbent.

**306 Composite or plural treating agents:**

This subclass is indented under subclass 299. Processes carried out in the presence of a solid contacting agent which is either a physical mixture of several solids or a complex chemical combination of such solids.

SEE OR SEARCH THIS CLASS, SUBCLASS:

149, for processes of conversion of mineral oil involving contacting the oil with a mixture of dissimilar solids.

**307 Silicon or carbon containing treating agent:**  
This subclass is indented under subclass 299. Processes wherein a silicon containing compound or a free carbon containing material is employed.

**308 FRACTIONATION:**  
This subclass is indented under the class definition. Processes for the separation of mineral oils into hydrocarbon fractions at least one of which is a mineral oil.

(1) Note. This subclass contains, for example, the separation of mineral oil components by physical processes or by treatment with emulsifying agents.

SEE OR SEARCH THIS CLASS, SUBCLASS:

177+, for processes of removing nonhydrocarbon impurities, gums or gum forming hydrocarbons from mineral oils.

SEE OR SEARCH CLASS:

588, Hazardous or Toxic Waste Destruction or Containment, subclass 405 for the destruction or containment of hazardous or toxic waste in the form of fractionated hydrocarbons.

**309 Deasphalting:**  
This subclass is indented under subclass 308. Processes wherein an asphaltic fraction is separated from the remaining portion of the mineral oil.

SEE OR SEARCH THIS CLASS, SUBCLASS:

39+, for processes of recovering, making or treating an asphalt as a product. Note particularly subclass 45 for the recovery of asphalt by extraction. Processes classified in this subclass (309) are those in which the object is to obtain a refined mineral oil of reduced asphalt content and there is no recovery of asphalt as a product.

86, for processes of deasphalting combined with a chemical conversion of the deasphalted mineral oil.

**310 Adsorption:**  
This subclass is indented under subclass 308. Processes wherein a mineral oil or mineral oil containing fluid mixture is contacted with a solid material which selectively adsorbs a mineral oil fraction from the mixture.

(1) Note. Processes classified herein may involve the treatment of a liquid mineral oil in order to selectively adsorb certain fractions therefrom or the treatment of a mineral oil vapor containing gaseous mixture to adsorb the mineral oil vapors therefrom.

SEE OR SEARCH THIS CLASS, SUBCLASS:

250, for desulfurizing processes wherein solid adsorbents are used involving solids contacting and mixing procedures.

299+, for refining processes wherein solid adsorbents are used to separate impurities.

SEE OR SEARCH CLASS:

95, Gas Separation: Processes, subclasses 90+ for processes of gas separation involving solid adsorbents. This subclass (310) provides for processes wherein a mineral oil is separated from a gas or vapor by use of a solid adsorbent which also include the recovery of a mineral oil product. Processes which involve a gas separation classifiable in Class 95 followed by the recovery of a mineral oil by name only, e.g., distillation or heating, are classified in Class 95.

210, Liquid Purification or Separation, particularly subclasses 656+ and 660+ for liquid separation or purification not elsewhere provided for, using solid sorbents. Processes of fractionating mineral oil by use of adsorbents is classified in this subclass (310).

**311 Liquid extraction with solvents:**

This subclass is indented under subclass 308. Processes 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 forming a solution or liquid phase which is immiscible with another oil fraction not so dissolved.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 31, and 33+, for processes of recovery or treatment of paraffin wax involving solvent extracting.
- 45, for processes of recovery of asphalt, tar, pitch or resin by solvent extraction.
- 87, for processes of solvent extracting mineral oil combined with conversion of the extracted oil.
- 96, for processes of converting mineral oil combined with solvent extracting the converted oil.

SEE OR SEARCH CLASS:

- 196, Mineral Oils: Apparatus, subclass 14.52 for apparatus specialized for the solvent extraction of mineral oils.
- 210, Liquid Purification or Separation, for processes of separating liquids not otherwise provided for.
- 422, Chemical Apparatus and Process Disinfecting, Deodorizing, Preserving, or Sterilizing, subclasses 255+ for extracting, leaching, or dissolving apparatus not otherwise provided for.
- 423, Chemistry of Inorganic Compounds, appropriate subclasses for processes directed to extracting, leaching or dissolving therein provided for and subclass 658.5 (Class 423) for extracting, leaching or dissolving processes not otherwise provided for.
- 554, Organic Compounds, subclasses 9 through 16 for processes of extraction for recovering fatty oil compounds.
- 585, Chemistry of Hydrocarbon Compounds, subclasses 833+ for processes of recovering particular hydrocarbons by solvent extraction.

**312 With blending of separated fractions with each other or with feed:**

This subclass is indented under subclass 311. Processes combined with the mixing of an extract mineral oil fraction with another mineral oil.

- (1) Note. The mineral oil with which the extract fraction is mixed may be another fraction of the same or different extraction process or an unextracted mineral oil.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 14+, for processes of mixing or blending mineral oil fractions not combined with the extraction process.

**313 Extractive distillation:**

This subclass is indented under subclass 311. Processes wherein mineral oil is distilled in the presence of a solvent.

SEE OR SEARCH CLASS:

- 203, Distillation: Processes, Separatory, subclasses 50+ for a separatory distillation process including adding a material to alter the relative volatility of the components of a mixture.

**314 Plural stages with different oil miscible solvents:**

This subclass is indented under subclass 311. Processes in which a mineral oil is subjected to a plurality of successive extractions, each involving the use of a different oil-miscible solvent, there being a separation of the extract phase from the oil between at least two of the extraction steps.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 321, for mineral oil extraction processes including solvent recovery or rehabilitation in which a second solvent miscible with the extraction solvent is employed to effect a separation of the extracted oil therefrom.
- 323+, for processes in which a mixture of solvent components is employed in a single extraction zone or where a solvent modifier is subsequently added

- to the extraction zone prior to any phase separation.
- 315 With recycle of product of later extraction to earlier extraction stage:**  
This subclass is indented under subclass 314. Processes wherein at least one of the extracted fractions of a later extraction step is returned to an earlier extraction step.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
318, for extraction processes involving recycle of a fraction thereof which include the use of only one solvent (whether single or plural stage operation).
- 316 Difference is mere change in proportions of solvents:**  
This subclass is indented under subclass 314. Processes wherein the solvents used in each extraction contain essentially the same ingredients but differ from each other in the proportions thereof.
- 317 Counter current multistage extraction:**  
This subclass is indented under subclass 311. Processes wherein mineral oil is subjected to extraction in a plurality of stages the oil and the solvent employed flowing from stage to stage in opposite directions.
- 318 With recycle of oil:**  
This subclass is indented under subclass 311. Processes wherein a phase or product of an extraction step is returned to either the same or a previous extraction zone.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
315, for plural stage extraction processes with different solvents including recycle of a product fraction.
- 319 With pressure variation:**  
This subclass is indented under subclass 311. Processes, (1) wherein there is a change in the pressure exerted on a single extraction zone to effect a separation of the phases thereof or (2) wherein each of several extraction zones is maintained under different pressure.
- 320 With temperature gradient in extraction zone or between extraction zones:**  
This subclass is indented under subclass 311. Processes wherein (1) there is maintained a difference of temperature between different locations in a single extraction zone, or (2) wherein each of several extraction zones is maintained under a different temperature.
- 321 With solvent rehabilitation:**  
This subclass is indented under subclass 311. Processes combined with a particular treatment to remove or recover the solvent from a phase of the extraction.
- (1) Note. The mere recitation of the step of recovering the solvent by name only is not sufficient for classification in this subclass.
- (2) Note. This subclass provides for the specific separation of the mineral oil from the solvent, inferentially, solvent is also recovered.
- 322 Organic solvent containing:**  
This subclass is indented under subclass 311. Processes wherein an organic compound is employed as the extracting solvent medium.
- 323 With added solvent or solvent modifier:**  
This subclass is indented under subclass 322. Processes in which (1) the solvent initially comprises a mixture of compound at least one of which is organic, or (2) a plurality of solvents is added sequentially without any intervening separation of the phases.
- (1) Note. The added component may be an additive which increases or decreases the solvent power of the primary solvent and may be added to effect phase separation.
- 324 Inorganic:**  
This subclass is indented under subclass 323. Processes wherein an inorganic compound is employed in addition to the organic component.
- 325 Heterocyclic:**  
This subclass is indented under subclass 322. Processes wherein a heterocyclic compound is employed as a solvent.

- carbocyclic amines, guanidines, oximes and quaternary ammonium compounds.
- 326 Hetero-N-containing:**  
This subclass is indented under subclass 325. Processes wherein the heterocyclic compound contains nitrogen in the ring.
- (1) Note. This subclass contains, for example, extraction processes using pyridine or morpholine as the solvent.
- 327 Furfural and derivatives:**  
This subclass is indented under subclass 325. Processes wherein the heterocyclic compound is furfural or a derivative thereof.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
325, for solvent fractionation of mineral oil which involve the use of a furane type heterocyclic compound other than furfural or derivative thereof.
- 328 Nonoxo carbonylic:**  
This subclass is indented under subclass 322. Processes wherein a nonoxocarbonylic compound is employed as the solvent.
- (1) Note. This subclass contains, for example, extraction processes using carboxylic acids, salts or amides, not classified above, as the solvent.
- 329 Carboxylic esters:**  
This subclass is indented under subclass 328. Processes wherein the nonoxocarbonylic compound is an ester of a carboxylic acid.
- 330 Nitrogen-containing solvent:**  
This subclass is indented under subclass 322. Processes wherein a nitrogen containing organic compound is employed as a solvent.
- (1) Note. This subclass contains, for example, extraction processes using nitro compounds or nitriles.
- 331 Amino compound:**  
This subclass is indented under subclass 330. Processes wherein the nitrogen containing organic compound includes an amine group.
- (1) Note. This subclass contains for example, extraction processes using acyclic or
- 332 Oxo compound containing:**  
This subclass is indented under subclass 322. Processes wherein an organic compound including an oxo group is employed as a solvent.
- (1) Note. This subclass contains, for example, extraction processes using aldehydes or ketones.
- 333 Oxy compound:**  
This subclass is indented under subclass 322. Processes wherein an organic compound including an oxy group is employed as a solvent.
- (1) Note. This subclass contains, for example, extraction processes using alcohols or alcoholates.
- 334 Ethers:**  
This subclass is indented under subclass 333. Processes wherein the oxy compound is an ether.
- 335 Aromatic:**  
This subclass is indented under subclass 333. Processes wherein an aromatic oxy compound is employed.
- (1) Note. This subclass contains, for example, extraction processes using phenols or phenolates.
- 336 Halogen containing:**  
This subclass is indented under subclass 322. Processes wherein a halogen containing compound is employed as a solvent.
- (1) Note. This subclass contains, for example, extraction processes using carbon tetrachloride, trichlorethylene, etc.
- 337 Hydrocarbon:**  
This subclass is indented under subclass 322. Processes wherein a hydrocarbon is employed as a solvent.
- (1) Note. This subclass contains, for example, extraction processes using propane.

**338 Liquid sulfur dioxide:**

This subclass is indented under subclass 311. Processes wherein liquid sulfur dioxide is employed as a solvent.

SEE OR SEARCH THIS CLASS, SUBCLASS:

242, for processes for desulfurizing mineral oil in which sulfur dioxide is employed.

**339 Liquid-liquid contacting:**

This subclass is indented under subclass 311. Processes directed to the particular procedure for contacting a mineral oil with liquid solvent.

(1) Note. This subclass is the collecting place for manipulative techniques for solvent fractionation of mineral oils. Processes involving some manipulative technique and limited to the use of a solvent provided for above are cross-referenced to this subclass if necessary.

SEE OR SEARCH THIS CLASS, SUBCLASS:

298, for processes of refining mineral oil involving some particular liquid to liquid contacting procedure.

**340 Recovery of mineral oil from natural or converted gases:**

This subclass is indented under subclass 308. Processes including recovery of liquid mineral oils, e.g., gasoline, from natural gases or from uncondensed gas-vapor mixtures obtained from a mineral oil conversion operation.

SEE OR SEARCH THIS CLASS, SUBCLASS:

95+, and particularly subclasses 100+ for mineral oil conversion processes combined with the subsequent separation of the vapor and liquid products.

310, for processes of recovering mineral oils from gas or vapor involving the use of solid adsorbents.

SEE OR SEARCH CLASS:

34, Drying and Gas or Vapor Contact With Solids, subclasses 72+ for apparatus there provided for combined

with means to recover vapors or other substances from gases.

95, Gas Separation: Processes, for processes for separating gases from mixtures of gases, liquids or solids. This and the indented subclasses (340+) provide for processes wherein a mineral oil is separated from a gas or vapor combined with the recovery of the mineral oil as a product. Processes which involve a gas separation procedure classifiable in Class 95 followed by the recovery of a mineral oil by name only, e.g., reciting only rectification, vacuum pressure or flash distillation, are classified in Class 95. Processes wherein the mineral oil recovery step includes any details thereof, or includes some subsequent treatment of the separated mineral oil are classified in Class 208.

62, Refrigeration, particularly subclasses 600+, 93+ and 272+ for processes and apparatus for separating vapors from gases by refrigeration.

261, Gas and Liquid Contact Apparatus, appropriate subclasses, for gas scrubbing apparatus.

423, Chemistry of Inorganic Compounds, subclasses 210+ for purifying or separating gases by a chemical reaction.

585, Chemistry of Hydrocarbon Compounds, especially subclasses 331+, 502+, and 709+ for condensation reactions of hydrocarbon gases to produce oily liquids.

**341 By absorption and vaporization:**

This subclass is indented under subclass 340. Processes wherein a gas mineral oil vapor mixture is contacted with a liquid (lean absorbent) which takes up or absorbs the mineral oil vapors therefrom (becoming an enriched or rich absorbent) combined with a specific step of vaporization to separate the mineral oil from the rich absorbent.

SEE OR SEARCH THIS CLASS, SUBCLASS:

347+, for processes of distilling mineral oil.

**342 With fractional condensation prior to absorption:**

This subclass is indented under subclass 341. Processes wherein the initial gas-vapor mixture is cooled to condense desired fractions prior to the absorption step.

- (1) Note. In the processes classified here, the fractional condensation prior to absorption is carried out to remove fractions boiling outside the range of the product desired or to recover a condensate which may be used as the lean oil in the absorption stage.

**343 Indirect heat exchange between lean and rich absorbent:**

This subclass is indented under subclass 341. Processes wherein the lean absorbent is passed in indirect heat exchange relationship with the rich absorbent.

- (1) Note. The heat from the desorbed lean oil is used to preheat or vaporize the rich oil.

SEE OR SEARCH THIS CLASS, SUBCLASS:

353, and 365, for heat exchange processes in the distillation of mineral oils.

SEE OR SEARCH CLASS:

196, Mineral Oils: Apparatus, subclass 134 for vaporizing apparatus having means to preheat the incoming oil by the heat of the vapors or unvaporized residue of distillation.

**344 Plural absorption stages:**

This subclass is indented under subclass 341. Processes wherein the gas-vapor mixture is subjected to a plurality of separate absorption treatments.

**345 At least one stage is under pressure:**

This subclass is indented under subclass 344. Processes wherein at least one of the absorption steps is under a pressure greater than atmospheric pressure.

**346 Absorption stage is under pressure:**

This subclass is indented under subclass 341. Processes wherein the absorption is carried out under a pressure greater than atmospheric pressure.

**347 Distillation:**

This subclass is indented under subclass 308. Processes wherein mineral oil mixtures are volatilized for the purpose of recovering specific fractions from the vapors produced by condensation.

- (1) Note. The material to be distilled is called the distilland and the products produced by condensation are called the condensate or distillate. Unvaporized material left in the still after vaporization has taken place is the residue.

- (2) Note. The absence of the volatilizing or condensing steps from the process does not exclude the patent from this and indented subclasses if it is evident or well known that the process is designed to be used in connection with such step.

- (3) Note. This and indented subclasses (347+) take processes of distillation of mineral oil, and patents are classified herein if distillation of mineral oil is the only species claimed or the only material disclosed. However, if distillation of a nonmineral oil is also claimed, or distillation of a nonmineral oil is disclosed with all claims being generic to both a mineral oil and a nonmineral oil, the patent is classified in Class 203, Distillation: Processes, Separatory, and cross-referenced to Class 208.

SEE OR SEARCH THIS CLASS, SUBCLASS:

41+, for processes of preparing or recovering asphalts, tars, pitches or resins by distillation.

46+, for vaporizing processes wherein the mineral oils are heated under conditions which chemically convert the oil forming a modified mineral (e.g., reforming) or to coke.

- 92+, for processes for distillation of mineral oil combined with the subsequent chemical conversion thereof.
- 100+, for processes of chemical conversion of mineral oil combined with subsequent separating mineral oil vapors and liquid products by procedures including distillation.
- 184+, for processes of refining or purification of used mineral oil including distillation treatments.
- 313, for processes of distilling mineral oil in the presence of a solvent.
- 341+, for processes of recovering mineral oils from natural or converted gases by absorption combined with distillation of the rich absorbent to recover mineral oil.

## SEE OR SEARCH CLASS:

- 196, Mineral Oils: Apparatus, subclasses 98 through 141 for apparatus peculiar to the distillation of mineral oil.
- 202, Distillation: Apparatus, appropriate subclasses, for distillation apparatus not otherwise provided for.

**348 With nonvapor compound added prior to or during vaporization:**

This subclass is indented under subclass 347. Processes wherein a nongaseous compound is added to the distilland prior to or during the distillation.

- (1) Note. The additive materials may aid the distillation, per se, or prevent corrosion of the apparatus, or may be volatilized during the distillation.

## SEE OR SEARCH THIS CLASS, SUBCLASS:

- 47, for process of converting mineral oil chemically wherein nongaseous materials are added to the system to prevent corrosion in the system.
- 125, through 127, for cracking processes wherein a nongaseous, noncatalytic compound is added.

## SEE OR SEARCH CLASS:

- 203, Distillation: Processes, Separatory, subclasses 6+, for a distillation process in which a nongaseous material is added to the distilland to inhibit corro-

sion and subclasses 50+ for a distillation process in which the nongaseous material is added to the distilland to aid the distillation.

**349 With nonvaporization treatment of liquid condensate or residue:**

This subclass is indented under subclass 347. Processes wherein the condensate or residue resulting from the distillation, each constituting a liquid product, is subjected to a nonvaporization treatment.

- (1) Note. The nonvaporization treatment may include a blending of any desired condensate fraction with other condensate fractions or with the residue, filtering, etc.

## SEE OR SEARCH CLASS:

- 203, Distillation: Processes, Separatory, subclasses 39+, for a distillation process including a disparate separation step subsequent to the distillation step.

**350 Rectification:**

This subclass is indented under subclass 347. Processes carried out in such a manner that vapor rising from the still comes into contact with a descending condensed portion of vapor previously evolved from the still.

- (1) Note. In rectification processes the refluxing condensate scrubs the higher boiling mineral oil constituents from the vapor stream, and at the same time is itself stripped of a portion of its content of low boiling mineral oil constituents.

## SEE OR SEARCH CLASS:

- 202, Distillation: Apparatus, subclasses 153+ and 158+ for distillation apparatus including a fractionating column.
- 203, Distillation: Processes, Separatory, appropriate subclass, for a separatory distillation process, and note particularly, subclasses 75, 82, 93, 94, 97, and 98 for a distillation process in which a separated condensate is returned to the distillation zone.

**351 C1-C4 alkane removal:**

This subclass is indented under subclass 350. Processes wherein normally noncondensable aliphatic hydrocarbon fractions having from 1 to 4 carbon atoms are removed from the system.

- (1) Note. This subclass contains, for example, processes of stabilizing gasoline or pressure distillates from a cracking operation by the rectification treatment.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 342, for fractional condensation treatments of mineral oil prior to an absorption treatment.

**352 Flash vaporization:**

This subclass is indented under subclass 350. Processes 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 resulting in the volatilization of at least a portion of the distilland.

- (1) Note. In flash vaporization, the distilland is usually heated at a pressure above atmospheric and released into a zone having a pressure less than atmospheric.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 361, for flash vaporization processes in nonrectification distillation processes.

SEE OR SEARCH CLASS:

- 203, Distillation: Processes, Separatory, subclass 88 for a flash distillation process.

**353 With heat recovery by indirect heat exchange:**

This subclass is indented under subclass 350. Processes wherein one component being distilled is heated by indirect contact with the same or another component of the process.

- (1) Note. In the processes classified herein, the heat exchange is usually between the hot residue and the incoming distilland.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 343, for processes of recovering mineral oil from gases including heat exchange between lean and rich absorbents.  
365, for heat exchange in nonrectification distillation processes.

SEE OR SEARCH CLASS:

- 196, Mineral Oils: Apparatus, subclass 134 for apparatus for distilling mineral oil having means to recover heat from the vapor or residuum.  
203, Distillation: Processes, Separatory, subclasses 21+ for a distillation process in which material being distilled is heated by indirect contact with itself or some other component in the process.

**354 Plural or combined with additional distillation:**

This subclass is indented under subclass 350. Processes wherein there are either two or more distinct rectification zones or at least one rectification zone combined with at least one nonrectification distillation zone.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 364+, for plural stages of non rectification distillation processes.

SEE OR SEARCH CLASS:

- 203, Distillation: Processes, Separatory, subclasses 71+ for a distillation process including two or more distinct distillation steps.

**355 With product recycle between distillation zones:**

This subclass is indented under subclass 354. Processes wherein either the vapors, condensate and/or residue from a later distillation zone is returned to an earlier distillation zone.

- (1) Note. In the processes classified herein, condensate may be recycled as a diluent or a condensing medium; heated residue may be recycled to effect reboiling of distilland in the earlier stage; or vapor may be recycled to assist in vaporizing

and stripping of the lower boiling constituents from the higher boiling constituents.

SEE OR SEARCH CLASS:

203, Distillation: Processes, Separatory, subclasses 75, 78, 82, and 84, for a distillation process including the step of returning a vapor, condensate and/or residue from a later distillation zone to an earlier distillation zone.

**356 With added gas or vapor (e.g., steam):**

This subclass is indented under subclass 350. Processes carried out in the presence of an added gas or vapor to effect volatilization of the distilland.

- (1) Note. The gas or vapor, for example, may be added prior to or during vaporization. Steam, carbon dioxide, nitrogen, methane, fuel gas, and combustion gases are examples of gases or vapors used in the processes classified herein, and may, for example, be added to lower the partial pressure of the volatile constituents permitting vaporization at lower temperatures.

SEE OR SEARCH THIS CLASS, SUBCLASS:

128+, for cracking processes wherein vapors are added to the mineral oil being heated prior to or during the cracking.  
362+, for nonrectification distillation processes carried out in the presence of an added gas or vapor.

SEE OR SEARCH CLASS:

196, Mineral Oils: Apparatus, subclasses 126 and 127 for mineral oil vaporizing apparatus having means to inject gases or vapors into the vaporizing zone.  
203, Distillation: Processes, Separatory, subclass 49 for a convective distillation process and subclasses 76, 79, 83, 85, 92+, and 95+ for a distillation process in which steam is added.

**357 Vacuum or pressure:**

This subclass is indented under subclass 350. Processes wherein the rectification zone is under a pressure greater or less than atmospheric pressure.

- (1) Note. The use of pressures varying from atmospheric changes the relative volatility of the components of the distilland which may lower the boiling point of the respective components of the mixture thereby increasing the ease of separation of the components of the distilland.

SEE OR SEARCH CLASS:

196, Mineral Oils: Apparatus, subclass 114 for vaporizers adapted to distill mineral oil under reduced pressure.  
203, Distillation: Processes, Separatory, subclasses 73+ and 91+ for a distillation process utilizing pressure or vacuum.

**358 With liquid product recycle to rectification zone:**

This subclass is indented under subclass 350. Processes wherein condensate or residue is returned to the rectification zone after having been removed therefrom to assist in the vaporization process.

SEE OR SEARCH CLASS:

203, Distillation: Processes, Separatory, subclass 98 for a distillation process including the step of returning a condensate or a residue to the distillation zone and note "SEARCH THIS CLASS, SUBCLASS" and "SEARCH CLASS" thereunder.

**359 Spraying:**

This subclass is indented under subclass 347. Processes wherein the distilland is sprayed into the vaporization zone.

SEE OR SEARCH CLASS:

196, Mineral Oils: Apparatus, subclass 128 for vaporizing apparatus having means to introduce the mineral oil as a spray into the vaporizing zone.  
202, Distillation: Apparatus, subclass 236 for distillation apparatus having means to spray the feed.

- 203, Distillation: Processes, Separatory, subclass 90 for a process of spraying the feed into the distillation zone.
- 239, Fluid Sprinkling, Spraying, and Diffusing, appropriate subclasses for the spraying device, per se.

**360 Filming:**

This subclass is indented under subclass 347. Processes wherein the distilland is introduced into the vaporization zone by spreading it as a thin film over a surface.

**SEE OR SEARCH CLASS:**

- 196, Mineral Oils: Apparatus, subclass 128 for mineral oil vaporizing apparatus having means to spread the oil as a film into the vaporizing zone.
- 202, Distillation: Apparatus, subclass 236 for distillation apparatus having means to spread the feed in the form of a film.
- 203, Distillation: Processes, Separatory, subclasses 72 and 89 for a distillation process of spreading the distilland as a thin film over a surface.

**361 Flash vaporization:**

This subclass is indented under subclass 347. Processes 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 resulting in the volatilization of at least a portion of the distilland.

- (1) Note. In flash vaporization, the distilland is usually heated at a pressure above atmospheric and released into a zone having a pressure less than atmospheric.

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

- 352, for processes of rectifying mineral oils including flash vaporization.

**SEE OR SEARCH CLASS:**

- 203, Distillation: Processes, Separatory, subclass 88 for a separatory distillation process of heating the distilland under pressure high enough to prevent ebullition and the distilland is then introduced into a zone of lesser pressure.

**362 With added gas or vapor:**

This subclass is indented under subclass 347. Processes wherein a gas or vapor is employed to effect volatilization of the distilland.

- (1) Note. The gas or vapor, for example, may be added prior to or during vaporization. Steam, carbon dioxide, nitrogen, methane, fuel gas, and combustion gases are examples of gases or vapors used in the processes classified herein, and may, for example, be added to lower the partial pressure of the volatile constituents permitting vaporization at lower temperatures.

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

- 43, for processes of obtaining tars and pitches by distilling tars in the presence of hot gases (e.g., coal gases).
- 128+, for cracking processes wherein vapors are added to the mineral oil being heated prior to or during cracking.
- 356, for processes of rectifying mineral oil in the presence of an added gas or vapor.

**SEE OR SEARCH CLASS:**

- 196, Mineral Oils: Apparatus, subclasses 126 and 127 for mineral oil vaporizing apparatus having means to inject gases or vapors into the vaporizing zone.
- 203, Distillation: Processes, Separatory, subclass 49 for a convective distillation processes and subclasses 76, 79, 83, 85, 92+, and 95+ for a distillation process in which steam is added.

**363 Steam:**

This subclass is indented under subclass 362. Processes wherein the added vapor is steam.

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

- 348, for mineral oil distillation processes wherein water has been added and which may be vaporized during distillation.

**364 Plural stages of vaporization:**

This subclass is indented under subclass 347. Processes wherein the vaporization is carried out in a plurality of separate and distinct zones.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

354+, for processes including a plurality of vaporization zones, at least one of which is a rectification zone.

**365 With heat recovery by indirect heat exchange:**

This subclass is indented under subclass 364. Processes wherein the distilland is heated by indirect contact with a heated product of the distillation from the same or from a different stage of vaporization.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

343, for processes of recovering mineral oil from gases including heat exchange between lean and rich absorbents.

353, for rectification processes which include indirect heat exchange.

SEE OR SEARCH CLASS:

196, Mineral Oils: Apparatus, subclass 134 for apparatus for distilling mineral oil having means to recover heat from the vapor or residuum.

201, Distillation: Processes, Thermolytic, subclasses 14+ for a thermolytic distillation process wherein the distilland is heated by indirect contact with a heated product of the distillation process.

203, Distillation: Processes, Separatory, subclasses 21+ for a separatory distillation process wherein the distilland is heated by indirect contact with a heated product of a distillation step.

**366 Vacuum or pressure:**

This subclass is indented under subclass 347. Processes wherein the vaporization zone is under a pressure greater or less than atmospheric pressure.

(1) Note. The use of pressures varying from atmospheric changes the relative volatil-

ity of the components of the distilland which may lower the boiling point of the respective components of the mixture thereby increasing the ease of separation of the components of the distilland.

SEE OR SEARCH CLASS:

196, Mineral Oils: Apparatus, subclass 114 for vaporizers adapted for distilling mineral oil under reduced pressure.

203, Distillation: Processes, Separatory, subclasses 91+, for a distillation process in which the distillation zone is under pressure or vacuum.

**367 With agitation of distilland:**

This subclass is indented under subclass 347. Processes wherein the distilland is kept in motion as by stirring during vaporization.

(1) Note. The agitation of the distilland during vaporization improves the circulation and helps prevent undesirable deposits from forming.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

48, for chemical conversion processes wherein carbon accumulations are prevented from forming on the equipment.

SEE OR SEARCH CLASS:

196, Mineral Oils: Apparatus, subclass 112 for rotary mineral oil stills and subclass 123 for mineral oil vaporizing apparatus having means to circulate or agitate the oil.

201, Distillation: Processes, Thermolytic, subclasses 31 and 33 for a process of thermolytic distillation in which the solid distilland is agitated.

202, Distillation: Apparatus, subclasses 175 and 265 for distillation apparatus having means to agitate the distilland.

203, Distillation: Processes, Separatory, subclass 20 for a distillation process in which the distilland is agitated to inhibit foaming and subclass 89 for a distillation apparatus in which the distilland film is agitated.

366, Agitating, appropriate subclass, for the agitating devices.

**368 Condensatin by direct heat exchange:**

This subclass is indented under subclass 347. Processes wherein the volatiles are condensed by direct heat exchange with a coolant (there being direct vapor or gas-liquid contact).

- (1) Note. Water or mineral oil condensate may be coolants used to condense volatiles.

**369 Volatile treatment other than condensation:**

This subclass is indented under subclass 347. Processes involving some noncondensation treatment of the volatiles evolved during the distillation.

- (1) Note. This subclass contains, for example, processes of filtering or heating the volatiles or utilizing them in some manner in the distillation operation.

**370 MISCELLANEOUS:**

This subclass is indented under the class definition. Processes not provided for in any other subclass.

- (1) Note. Included herein are miscellaneous treatments of mineral oils during transportation not provided for in any other class.

**SEE OR SEARCH CLASS:**

- 137, Fluid Handling, particularly subclass 13 for processes of improving the flow characteristics of fluids by addition of material or energy.  
507, Earth Boring, Well Treating, and Oil Field Chemistry, subclass 90 for compositions and processes for preventing contaminant deposits in petroleum oil conduits.

**390 TAR SAND TREATMENT WITH LIQUID:**

This subclass is indented under the class definition. Subject matter in which tar sand is contacted with a liquid material, ordinarily to dissolve or melt out the tar from the sand.

**391 Inorganic (only) liquid:**

This subclass is indented under subclass 390. Subject matter in which the liquid is inorganic, usually water.

- (1) Note. Treatment with a solvent mixture containing any organic diluent or adjunct in admixture with water is classified in subclass 390.

- (2) Note. A multistep extraction procedure is classified in this subclass only when each extraction step uses an inorganic liquid only.

**400 BY TREATMENT OF SOLID MINERAL, E.G., COAL LIQUEFACTION, ETC.:**

This subclass is indented under the class definition. Process wherein a liquid oily or tarlike hydrocarbonaceous mixture is recovered from a solid mineral material feed, such as coal, diatomite, oil shale, tar sand, etc.

- (1) Note. Included herein are processes which may be considered merely "physical" such as removal of hydrocarbonaceous liquids from tar sands or shale by melting as well as digestion, pyrolysis or other chemical conversions of such solids to obtain mineral oils.

- (2) Note. The solid feedstock material may be in a form big enough to be handled as individual pieces of solids, or may be in particulate form, so that it is handled as fluent solids, or may be solid particles slurried in a liquid or gas.

- (3) Note. The designation of the feed by a term which usually implies a solid, e.g., "coal", "oil shale", "tar sands", etc., is sufficient basis to classify a patent in this or an indented subclass; however, it should be noted that a feedstock referred to as "shale oil", "coal liquids", etc., is not a solid and is provided for elsewhere in the class.

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

- 39+, for asphalt treatment including the treatment of solid natural asphalts found in substantially pure condition.

## SEE OR SEARCH CLASS:

- 44, Fuel and Related Compositions, appropriate subclasses for a solid product which is coke or modified coal, especially subclasses 620+ for a miscellaneous coal-treating process or a product thereof. A process for producing such a solid product from coal, whether or not also produced, is also classified in Class 44 if the process is not suitable for classification in Class 201. Where a patent has a claim suitable for placement in Class 44 and another claim for Class 208, it is placed as an original in Class 44 and cross-referenced to this class (208).
- 48, Gas: Heating and Illuminating, subclasses 197+ for a fuel gas composition and/or a process for manufacture thereof not elsewhere provided for. Where a solid mineral material is treated to recover a solid fuel product, the product is classified in Class 44 and the process is classified in Class 44 or Class 201, as appropriate, whether or not recoverable liquid or solid materials are produced. Where a solid mineral material is treated to produce a liquid hydrocarbon mixture, the product is classified in this class (208) and the process also is classified in this class, whether or not a recoverable fuel gas is also produced. However, a patent having a Class 48 product claim and a Class 208 process claim is classified in Class 48 and cross-referenced to Class 208.
- 62, Refrigeration, subclasses 600+ for the extraction, per se, of a component from a mixture of gases by liquefaction and separation.
- 166, Wells, subclasses 244.1+ for a process of recovering fluid materials or hydrocarbons converted to the fluid state from wells, especially subclasses 256+ for processes involving in situ combustion, subclasses 272.1+ for processes involving injection and producing wells and heating the formation and subclass 302 for miscellaneous processes involving heating.
- 201, Distillation: Processes, Thermolytic, appropriate subclasses for a process wherein a solid carbonaceous feedstock is subjected to pyrolysis and a solid coke or char is produced as a recoverable product, whether or not a liquid mineral-oil-like product is also produced. Where in all the claims of such a patent any char which is produced by pyrolysis is burned as fuel in the process etc., the patent is classified as an original in Class 208 and cross-referenced to Class 201, where desired.
- 202, Distillation: Apparatus, subclasses 91+, 96+, 211+, and 217+ for apparatus for the pyrolytic conversion of solids to coke where there is no subsequent treatment of the carbon product to form a mineral oil.
- 299, Mining or In Situ Disintegration of Hard Material, subclass 2 for tunnel recovery of fluid mineral, and subclasses 3+ for in situ conversion of solid material other than hydrocarbon to fluid for recovery.
- 518, Chemistry: Fischer-Tropsch Processes; or Purification or Recovery of Products Thereof, appropriate subclass for a process wherein an organic compound or mixture or organic compounds is produced by the hydrogenation of a carbon oxide. A patent claim to a multi-step process where the carbon oxide which is hydrogenated is produced from a solid mineral is classified in Class 518 when all of the liquid product follows the route: Solid to carbon oxide to liquid hydrocarbon, but is classified in this class (208) when at least some of the liquid product is not derived from carbon oxide.
- 585, Chemistry of Hydrocarbon Compounds, subclasses 240+ for the production of a mineral-oil-like mixture from wood or solid nonmineral refuse, other appropriate subclasses for the production of named specific hydrocarbon compounds, and subclass 943 for a collection of patents concerning conversion of coal or char to a specific hydrocarbon compound.

**401 Including a test or measurement:**  
This subclass is indented under subclass 400. Subject matter in which the process includes a step of testing or measuring any parameter involved in the procedure.

- (1) Note. Merely abiding by a specified parameter, e.g., operating at a prescribed temperature range in performing the process, is not considered measuring or testing.
- (2) Note. Included in the subclass are those processes wherein a step is controlled in response to the result of a test or measurement.

**SEE OR SEARCH CLASS:**

73, Measuring and Testing, appropriate subclasses, for certain measuring and testing processes, per se, and the notes to the main class definition thereof for the locus of other measuring and testing processes.

**402 Using electrical, magnetic or wave energy:**  
This subclass is indented under subclass 400. Subject matter which includes a step of (1) passing an electric current directly through a feedstock, intermediate, product or other material used in process or (2) subjecting any material in the process to an electric or magnetic field or (3), directly applying radiant energy to the material.

- (1) Note. The energy employed must be applied directly to the material as part of the total process (including pretreatment or posttreatment).
- (2) Note. Where the electrical energy is not applied directly to the material, but is used to generate heat energy that is transferred to the material before, during or after the operation, see other subclasses of this class.
- (3) Note. The wave energy applied to the work may be light, sonic, ultrasonic, emanations of radioactive material, infrared rays, ion bombardment, etc.

**SEE OR SEARCH CLASS:**

- 204, Chemistry: Electrical and Wave Energy, subclasses 155+ for chemical production of a compound or element by electrical or wave energy in a magnetic field, subclasses 157.15+ for wave energy treatment involving chemical reaction, subclasses 164+ for chemical treatment of a compound or element by an electrostatic field or electrical discharge, subclasses 513+ for electrophoretic or electro-osmotic separation or purification of a hydrocarbon oil, and subclasses 559+ for electrostatic separation or purification of a liquid hydrocarbon.
- 205, Electrolysis: Processes, Compositions Used Therein, and Methods of Preparing the Compositions, appropriate subclasses for electrolytic treatment of a mineral oil.
- 219, Electric Heating, subclasses 600+ for inductive heating, subclasses 678+ for microwave heating, and subclasses 764+ for capacitive dielectric heating.
- 250, Radiant Energy, appropriate subclasses for general utilization of ray energy in all forms.

**403 Chemical modification of solids before hydrogenation:**

This subclass is indented under subclass 400. Subject matter including a hydrogenation step and a step, upstream of the hydrogenation, in which a solid feed to the process undergoes a partial chemical reaction, which does not change the essential nature of the feed; e.g., coal may be deoxygenated or desulfurized, but it is not solublized or converted to coke.

- (1) Note. A step of hydrogenation is any chemical conversion step specified as being performed in the presence of free hydrogen or a compound specified as being a hydrogen donor.
- (2) Note. Mere removal of chemically non-bound water is not considered to be a chemical modification for this subclass.

- SEE OR SEARCH CLASS:  
44, Fuel and Related Compositions, subclasses 620+ for chemical modification of coal, per se, without liquefaction.
- 404 Using molten additive, e.g., heat carrier, etc.:**  
This subclass is indented under subclass 400. Subject matter having a step wherein a heated liquid material is added to a feedstock, an intermediate or a product of the process, which material is a solid at normal temperature and pressure.
- 405 Molten catalyst:**  
This subclass is indented under subclass 404. Subject matter wherein the heated liquid material is a reaction promoter or retarder other than a reactant, a solvent or other dispersing agent.
- 406 Halide-containing:**  
This subclass is indented under subclass 405. Subject matter in which the catalyst contains a compound of F, Cl, Br, I or At.
- 407 Specified agitation or circulation in gas contact zone:**  
This subclass is indented under subclass 400. Subject matter including a step of contactation a solid or liquid with a gas, wherein the circulation pattern of the solid or liquid during the gas contacting, e.g., countercurrent flow, etc., is claimed or in which the solid or liquid moves in a particular way, e.g., horizontally, etc., while being contacted.
- (1) Note. A claim that the contact takes place in a contact apparatus having a particular orientation, for example, a "horizontal contactor" usually is enough for placement in this subclass.
- 408 Gas includes hydrogen:**  
This subclass is indented under subclass 407. Subject matter wherein a gas containing elemental hydrogen, added to the process, is present in the gas contact zone.
- (1) Note. The presence of hydrogen gas normally produced during retorting operation is not sufficient for replacement of a patent in this subclass.
- 409 Vertical gas upflow, e.g., fluidization, etc.:**  
This subclass is indented under subclass 407. Subject matter in which the gas moves vertically upward in the contact zone.
- (1) Note. The movement of solid or liquid may be concurrent with or countercurrent to the movement of the gas.
- (2) Note. A mere statement in a claim that fluidization occurs is sufficient for placement in this subclass.
- 410 Using solid heat carrier:**  
This subclass is indented under subclass 409. Subject matter in which a solid material is used to provide heat to the feed or to an intermediate in the process by direct contact.
- (1) Note. The solid material may be catalytic or inert, insofar as it provides direct contact heat.
- (2) Note. The mere burning of a solid material is usually not sufficient for classification in this subclass unless it comes into direct contact with the feedstock to be heated.
- (3) Note. The heat carrier may comprise solids produced in the process which are removed from a feedstock treatment zone and recycled to the same zone, with or without an intermediate increase in the heat content of the solids.
- 411 Employing solid heat carrier:**  
This subclass is indented under subclass 407. Subject matter in which a solid material is used to provide heat by direct contact with the feed or and intermediate in the process.
- (1) Note. The solid material may be catalytic or inert, insofar as it provides direct contact heat.
- (2) Note. The mere burning of a solid material is usually not sufficient for classification in this subclass unless it comes into direct contact with the feedstock to be heated.

**412 Plural hydrogenation steps:**

This subclass is indented under subclass 400. Subject matter in which a feedstock is subjected to more than one hydrogenation treatment during the process.

- (1) Note. The plurality of the steps may be characterized by a completely disparate nature of the steps, e.g., one step being a treatment with gaseous hydrogen, another being a hydrogen donor treatment, or the difference in the steps may be a mere claimed change in hydrogenation condition, e.g., a change in temperature, pressure, concentration of reactants, etc.
- (2) Note. Both hydrogenations must be applied to a material which is taken off as a product of the process, whether one or both hydrogenations are applied to only the product fraction, the entire feedstock or any product stream therebetween.

SEE OR SEARCH THIS CLASS, SUBCLASS:

416, for a process wherein a recycle stream is hydrogenated.

**413 Solid catalyst in at least one step:**

This subclass is indented under subclass 412. Subject matter in which the claimed hydrogenation conditions of at least one step include the presence of a solid material disclosed as being a catalyst.

**414 With hydrogen production from water:**

This subclass is indented under subclass 400. Subject matter having a step wherein hydrogen contained in water is converted to free hydrogen.

- (1) Note. The water may be in any form, e.g., steam, water of hydration, etc.
- (2) Note. Often the water is contacted at an elevated temperature with CO or the coke or char formed by pyrolysis of part or all of the solid feedstock.

SEE OR SEARCH CLASS:

- 48, Gas: Heating and Illuminating, subclasses 204+ for a process of making a so-called "water gas" mixture.
- 423, Chemistry of Inorganic Compounds, subclass 647.7 for a process, per se, of making elemental hydrogen.

**415 Including contact of feed with liquid produced in the process, i.e., recycle:**

This subclass is indented under subclass 400. Subject matter wherein material derived from the solid feed is withdrawn from a later stage of the process and contacted, at an earlier stage of the process, with the solid feed to the process or with other feed-derived material.

**416 With discrete hydrogenation of recycle stream:**

This subclass is indented under subclass 415. Subject matter in which the material removed from the process stream for recycle is hydrogenated, apart from the main process stream.

**417 Recycle of bottoms (resid):**

This subclass is indented under subclass 415. Subject matter in which a distillation is performed upon an intermediate mixture in the process, and the nonvaporized portion from the distillation operation is recycled.

**418 Including contact with hydrogen gas:**

This subclass is indented under subclass 415. Subject matter wherein hydrogen gas, pure or in admixture with other gases is present in the reactor during or after the contactation with the recycle stream.

**419 Using specifically added catalyst during hydrogenation:**

This subclass is indented under subclass 400. Subject matter in which the process conditions for hydrogenation include the presence of a material claimed as a catalyst, added to the hydrogenation zone from a source other than the solid feed material.

- (1) Note. The presence in the hydrogenation zone of feed-stock derived material such as sand from tar sand, char from pyrolysis, etc., does not indicate classification in this subclass, even when such material is described as having catalytic activity.

- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
405, for a process which uses a molten catalyst.
- 420 Dissolved or suspended-thermally-decomposable catalyst, component or precursor:**  
This subclass is indented under subclass 419. Subject matter in which the catalyst, a component thereof, or a precursor thereof is dissolved in the reaction mixture or in which the reaction mixture contains in suspension a catalyst component or catalyst precursor which will decompose under the elevated temperature conditions of the reaction.
- 421 Containing Group VI transition metal:**  
This subclass is indented under subclass 419. Subject matter in which the catalyst contains one or more of chromium, molybdenum or tungsten in free or combined form.
- 422 And Group VIII metal:**  
This subclass is indented under subclass 421. Subject matter in which the catalyst contains one or more of cobalt, iron or nickel, or a platinum group metal, in free or combined form, in addition to the Group VI transition metal.
- 423 Containing Group VIII metal:**  
This subclass is indented under subclass 419. Subject matter in which the catalyst contains one or more of cobalt, iron or nickel, or a platinum group metal (Pt, Pd, Ir, Rh, Ru, or Os), in free or combined form.
- 424 Specified procedure to improve separation of solids from liquid product:**  
This subclass is indented under subclass 400. Subject matter in which a procedure, more than mere "separation" is claimed for removal of solids from the liquid product of the process.
- 425 Including centrifugation, filtering, flotation or vibration:**  
This subclass is indented under subclass 424. Subject matter wherein the specified procedure includes the use of centrifugal force, shaking, or the attachment of gas bubbles to a solid, or the passage of liquid through a septum which holds back solids of a certain size.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
402, for a process which involves the use of sonic or supersonic vibrations.
- 426 Including agglomeration, comminution or size-classification of solids:**  
This subclass is indented under subclass 400. Subject matter wherein a step segregates solids in the stream into different locations, based upon difference in size, causes solid particles to join to provide larger-size particles, or breaks particles into smaller-size particles.
- (1) Note. The step may take place before, during or after the chemical or physical processing of the solid feedstock.
- 427 Including burning of feed or product:**  
This subclass is indented under subclass 400. Subject matter in which the solid feed or a portion thereof, or a portion of the product, is combusted with oxygen or oxygen-containing material for any purpose.
- SEE OR SEARCH CLASS:  
34, Drying and Gas or Vapor Contact With Solids, subclass 428 for a process of cooling solids by mere contact with a gas, that is, a quenching process, per se.  
166, Wells, subclasses 256+ for a method of underground combustion of carbonaceous materials.  
299, Mining or In Situ Disintegration of Hard Material, subclasses 3+ for a method of in situ conversion of a solid material to a fluid.  
518, Chemistry: Fischer-Tropsch Processes; or Purification or Recovery of Products Thereof, appropriate subclass for a generalized hydrogenative conversion of a carbon oxide to a hydrocarbon mixture.
- 428 Including contact with extraneous additive other than hydrogen, e.g. solvent, etc.:**  
This subclass is indented under subclass 400. Subject matter wherein the feed material, an intermediate material, or a product mixture is contacted with a substance, other than hydrogen, brought in from outside the process.

- (1) Note. The substance may be disclosed as a catalyst, a solvent, etc.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

415, for a process having a step of liquid recycle.

**429 Distinct addition zones:**

This subclass is indented under subclass 428. Subject matter in which additive comes into contact with feedstock in a plurality of distinct contact zones.

- (1) Note. The same additive may be employed in each contacting zone.
- (2) Note. An extraction which occurs in a contacting zone may extract or dissolve desired hydrocarbon fractions or may be a mere washing or leaching of inorganic components, etc.

**430 Contact with an additive, followed by chemical conversion:**

This subclass is indented under subclass 428. Subject matter wherein a chemical conversion step is performed after a feed or intermediate is contacted with an additive, e.g., mixing followed by conversion, extraction followed by conversion of extract, etc.

- (1) Note. Examples of Chemical conversions are cracking, coking, etc.
- (2) Note. The chemical conversion may take place in the same chamber to which the additive is added, provided that the conversion is downstream of the contacting step.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

427, for a process which includes combustion of feed or product.

**431 Specified hydrogen-donor solvent:**

This subclass is indented under subclass 428. Subject matter including contact with a solvent compound or mixture of compounds which can be oxidized by contact with the hydrogenatable feed or intermediate.

- (1) Note. It is not necessary that the solvent material be expressly claimed as a hydrogen donor solvent as long as it is understood to provide a hydrogenation function.

**432 With specified circulation procedure in contact zone:**

This subclass is indented under subclass 428. Subject matter wherein a specified agitation or circulation pattern, maintained by a fluid within a single contact zone, is claimed, or in which the location of streams associated with the contact zone are defined to establish a specific circulation pattern, e.g., use of a rotating kiln, etc.

**433 Simultaneous treatment with gaseous additive and liquid solvent:**

This subclass is indented under subclass 428. Subject matter wherein a normally liquid solvent and a normally gaseous additive come into direct contact with the feed or intermediate material in a single zone.

- (1) Note. "Normal" conditions are usually based upon normal operating conditions of the process involved. When such process conditions are not stipulated (i.e., temperature, pressure) normal conditions are taken to be at standard conditions (i.e., 25° C, 1 atom pressure).
- (2) Note. The gas may be hydrogen-containing gas.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

418, for a process wherein a feed-stock is contacted with hydrogen and a solvent produced in the process and recycled from a late stage, in the same zone or different zones.

**434 Additive is petroleum or fraction from petroleum refining:**

This subclass is indented under subclass 428. Subject matter wherein crude or refined mineral oil from an outside source is mixed with the solid feed to the process or with an intermediate or product derived from the solid feed.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

415+, for contact of the feed with a fraction from its own refining.

**435 Additive is specified catalyst or liquid solvent or dispersant:**

This subclass is indented under subclass 428. Subject matter in which the additive is claimed to be a catalyst for a chemical reaction or a liquid which is claimed to dissolve or disperse at least one other material in the process.

CROSS-REFERENCE ART COLLECTIONS

**950 PROCESSING OF FISCHER-TROPSCH CRUDE: END**

Collection of documents drawn to chemical conversion, fractionation, refining, etc., of hydrocarbonaceous feedstocks produced by the hydrogenation of carbon oxides.

SEE OR SEARCH CLASS:

518, Chemistry: Fischer-Tropsch Processes; or Purification or Recovery of Products Thereof, subclasses 700+ for hydrogenation of carbon oxides, per se, especially subclasses 723+ for such process combined with a further treatment.

585, Chemistry of Hydrocarbon Compounds, appropriate subclasses for the production of a specific hydrocarbon from a Fischer-Tropsch crude feedstock.

**951 SOLID FEED TREATMENT WITH A GAS OTHER THAN AIR, HYDROGEN OR STEAM:**

This subclass is indented under subclass 400. Collection of patents in which a solid carbonaceous material feedstock of the type of ... is treated with a gas or gaseous mixture containing other than air hydrogen or steam, e.g., H<sub>2</sub>S, CO, CH<sub>4</sub>, etc., alone or admixed with each other or another gas.

**952 SOLID FEED TREATMENT UNDER SUPERCRITICAL CONDITIONS:**

Collection of patents in which a solid hydrocarbonaceous mineral of the type of subclasses 390+ or 400+ is treated to remove mineral oil therefrom, or to convert solid materials therein

to mineral oil-like mixture by the use, in any step of the treatment, of a treating gas in its supercritical stated. The treating agent may be a liquid, solid or gas at normal conditions, but the treatment conditions must include temperature near the critical temperature of the extractant. Under such conditions, the gaseous agent can not be liquified at any pressure, although the fluid density may be increased significantly by applying sufficient pressure. The agent need not necessarily be a solvent for the hydrocarbonaceous materials at normal conditions. The treatment may be designed to produce any sort of chemical, physical or physico-chemical result.