

## **CLASS 201, DISTILLATION: PROCESSES, THERMOLYTIC**

### **SECTION I - CLASS DEFINITION**

#### **GENERAL STATEMENT OF CLASS SUBJECT MATTER**

This is the residual class for thermolytic distillation processes not otherwise provided for. For purposes of this class thermolytic distillation is limited to the heating of a solid carbonaceous material (distilland) to vaporize the portion volatile under the conditions employed and to cause a compound or compounds in the material to undergo chemical decomposition (thermolysis) to form different chemical substances, at least some of which are volatile under the condition employed and an unvaporized solid carbonaceous material (residue). At least a part of the vaporized material is usually condensed to a liquid (distillate). See Lines With Other Classes, below, for lines between this class (201) and other classes having processes including thermolysis of carbonaceous material.

Solid carbonaceous materials within the purview of this class (201) include (exemplary but not limiting) such minerals as coal and oil shale and substances of an organic nature such as organic wastes and wood. Inorganic carbonates are excluded.

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

#### **LINES WITH CHEMICAL COMPOSITION CLASSES**

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

(2) Processes for heating solid, carbonaceous material to cause decomposition of compounds therein and to produce a solid, carbonaceous residue are classified here only if not otherwise provided for.

(a) Processes of thermolytically decomposing a carbonaceous material to produce carbon black, graphite, or other purified carbon are classified elsewhere. See References to Other Classes, below, for specific classes/subclasses.

(b) Processes for carbonizing a solid carbonaceous material to produce an electrically conductive product are classified elsewhere. A carbonized composition (e.g., activated carbon) claimed or disclosed solely as a sorbent or catalyst or a method of making such composition is classified elsewhere. See References to Other Classes, below, for specific classes/subclasses.

(c) The line between processes in this class (201) and Class 44, Fuel and Related Compositions, is that this class (201) takes a carbonization process wherein the carbonization is specified as being complete or a vaporized component is intended to be recovered, while Class 44 takes a process wherein the extent of carbonization is not specified or the disposition of any vaporized component is irrelevant to the process, only the final solid fuel product being of concern.

(d) Class 48, Gas: Heating and Illuminating, takes processes and apparatus for making heating and illuminating gases when no solid carbonaceous residue is left.

(e) The line between this class (201) and Class 208, Mineral Oils: Processes and Products, is (1) thermolytic distillation of a distilland consisting predominately of solid carbonaceous material and a minor amount of a mineral oil material to produce a char is in this class (201), (2) thermolytic distillation of a distilland consisting predominately of a mineral oil material and a minor amount of a previously charred material is classified in Class 208, (3) for processes including extracting mineral oils from natural, solid, carbonaceous material as well as the digestion or conversion of the same as the digestion or conversion of the same to obtain mineral oils see Class 208, Mineral Oils: Processes and Products, subclass 8 for the line.

#### **PROCESSES INCLUDING EVAPORATION**

Processes for evaporating without a condensing step are generally excluded from this class. For specific lines between the processes of this class and other processes including an evaporating step, see below.

(1) This class (201) is distinguished from Class 34, Drying and Gas Or Vapor Contact With Solids, in that the material herein is a solid or semi-solid which is chemically changed by the heating step so as to yield volatile substances containing condensable or absorbable components, while the material of Class 34 is a solid or semi-solid from which it is desired to remove an extraneous liquid, leaving the residue chemically unchanged, even though the volatile material be condensed.

(2) Class 134, Cleaning and Liquid Contact With Solids, takes claimed combinations of work handling or supporting means or steps with means or steps to apply a liquid to the work, as by spraying or immersion, where said liquid is distilled or evaporated, whether or not the resulting vapor is (1) directly contacted with the work or (2) condensed for re-use to contact the work. When only the liquid distillation subcombination or the vapor-phase work contact subcombination has been claimed, see above for the line between Class 201 and Class 34.

### (3) Evaporation Processes

Processes in which volatile components of the material being heated are removed as vapor without at least a portion of the vapor being condensed to a liquid are not within the purview of this class (201). See References to Other Classes, below, for some classes which provide for processes that include an evaporating or concentrating step.

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

## SECTION III - REFERENCES TO OTHER CLASSES

### SEE OR SEARCH CLASS:

- 23, Chemistry: Physical Processes, for processes that include an evaporating or concentrating step.
- 44, Fuel and Related Compositions, subclasses 500+ for a particulate solid fuel composition and subclasses 550+ for a consolidated fuel solids composition.
- 48, Gas: Heating and Illuminating, subclasses 200, 201 and 202 for a process for gasifying a mixture which includes coal and subclass 210 for a process for gasifying coal alone.
- 75, Specialized Metallurgical Processes, Compositions for Use Therein, Consolidated Metal Powder Compositions, and Loose Metal Particulate Mixtures, appropriate subclasses for a process of reducing an ore to the metallic state or refining molten metal involving distillation or for a sublimation process.
- 95, Gas Separation: Processes, for processes of gas separation.
- 106, Compositions: Coating or Plastic, appropriate subclasses for a coating composition which may be applied to surfaces of the distillation

- apparatus or utilized for making apparatus of a particular composition.
- 110, Furnaces, subclasses 235+ for a device for burning garbage or sewage, subclass 229 for a furnace having a special repository for fuel for eliminating the combustible gases and burning them before the coked fuel is fed to the fire and subclasses 101+ for a device for feeding fuel to a furnace. Under Class 110, class definition, see Class 122, Liquid Heaters and Vaporizers, and Class 126, Stoves and Furnaces, for the lines among these classes.
- 122, Liquid Heaters and Vaporizers, for apparatus and methods for heating liquids, generating vapors from liquids, treating the vapors generated and conserving the heat remaining in the liquid or vapor after part of the heat has been used. See particularly subclass 66 for devices containing a water cooled coking chamber for fuel.
- 127, Sugar, Starch, and Carbohydrates, for processes that include an evaporating or concentrating step.
- 134, Cleaning and Liquid Contact With Solids, subclasses 1+ for a cleaning process particularly subclasses 20 and 39, for a process of removing carbon, subclass 12 for a cleaning process including distilling the cleaning agent and subclass 31 for a cleaning process including the step of condensing a gas or vapor.
- 159, Concentrating Evaporators, for processes that include an evaporating or concentrating step.
- 162, Paper Making and Fiber Liberation, subclasses 30.1+ for a process of destroying the organic constituents of the waste liquor.
- 252, Compositions, subclasses 502+ for an electron conductive or emissive composition containing free carbon and process of making.
- 252, Compositions, appropriate subclasses, for processes of thermolytically decomposing a carbonaceous material.
- 260, Chemistry of Carbon Compounds, for processes that include an evaporating or concentrating step.
- 264, Plastic and Nonmetallic Article Shaping or Treating: Processes, subclasses 29.1+, for processes for carbonizing a solid carbonaceous material to produce an electrically conductive product
- 266, Metallurgical Apparatus, for apparatus peculiarly adapted for the treatment of metals or metalliferous material.

- 299, Mining or In Situ Disintegration of Hard Material, subclasses 3+ for a process of converting coal or oil shale in place to fluid material, whether a coke-like residue remains or not.
- 366, Agitating, subclasses 219+ for apparatus for agitating a liquid or a particulate material by motion of the container, and subclasses 241+ for a fixed container with movable stirring apparatus, particularly subclasses 262+ for pump type stirrers.
- 406, Conveyors: Fluid Current, appropriate subclasses for apparatus for conveying solid material in a current of air or other gas.
- 414, Material Article or Handling, subclasses 147+ for charging devices for placing a charge in or removing one from an oven or furnace, and subclasses 800+ for a process of material or article handling.
- 423, Chemistry of Inorganic Compounds, appropriate subclasses for processes of producing inorganic compounds and nonmetallic elements by chemical reaction, which may include a distillation step.
- 423, Chemistry of Inorganic Compounds, subclasses 445+ for processes of thermolytically decomposing a carbonaceous material.
- 426, Food or Edible Material: Processes, Compositions, and Products, for processes that include an evaporating or concentrating step.
- 502, Catalyst, Solid Sorbent, or Support Therefor: Product or Process of Making, especially subclasses 174+ and 416+ for a catalyst or sorbent containing carbonized material or a process of making such composition.
- 502, Catalyst, Solid Sorbent, or Support Therefor: Product of Process of Making, for a carbonized composition (e.g., activated carbon) claimed or disclosed solely as a sorbent or catalyst or a method of making such composition
- 585, Chemistry of Hydrocarbon Compounds, for processes that include an evaporating or concentrating step.
- 588, Hazardous or Toxic Waste Destruction or Containment, subclass 312 and 313-320 for the use of process distillation and thermolytic processes to destroy hazardous waste.
- other chemical change, furnishes at least part of the heat for thermolysis and volatilization of either the inherent or the thermolyzed volatile matter.
- CARBONACEOUS MATERIAL**
- Any solid material (mixture or compound) other than an inorganic carbonate which contains carbon or carbon containing compounds such as coke or wood.
- CHAR**
- The generic term applied to the carbonaceous residue from a thermolytic distillation of any carbonaceous material. It encompasses such terms as bone black, charcoal and coke.
- COKE**
- Strictly this is the amorphous, solid residue of coal after the volatile material has been distilled off in a thermolytic distillation. The term is also applied in the art to the solid, carbonaceous residue from the thermolytic distillation of such materials as oil shale, petroleum and pitch.
- CONDENSATE**
- See Distillate in the Class Definition section.
- DESTRUCTIVE DISTILLATION**
- See thermolytic distillation.
- DISTILLAND**
- For the purpose of this class is the carbonaceous material which is undergoing a distillation operation.
- DISTILLATE**
- The liquid product condensed from vapor during the distillation operation.
- EVAPORATION**
- The process of changing a solid or liquid into a vapor. This is the generic term for both sublimation and vaporization. It differs from "distillation" in that distillation includes the additional step of condensing vapor produced to a liquid.
- SEPARATORY DISTILLATION**

## SECTION IV - GLOSSARY

### AUTOTHERMIC DISTILLATION

A thermolytic distillation operation in which the distilland, either by combustion of a portion of itself or by

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

#### SUBLIMATION

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

#### THERMOLYTIC DISTILLATION

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

#### SUBCLASSES

##### 1 WITH MEASURING, TESTING OR INSPECTING:

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

##### SEE OR SEARCH CLASS:

- 73, Measuring and Testing, appropriate subclasses, particularly 700+ for a device for the direct measurement of pressure.
- 137, Fluid Handling, subclasses 2+ for a process of fluid handling in which one or more characteristics or conditions of a fluent material are determined.
- 162, Paper Making and Fiber Liberation, subclass 238 for a digester with automatic control means.
- 196, Mineral Oils: Apparatus, subclass 132 for a mineral oil vaporizer provided with means for automatically maintaining desired conditions.
- 202, Distillation: Apparatus, subclasses 151, 160, 193, 196, and 206 for distillation apparatus having control devices and see "SEARCH CLASS" under each subclass for related fields of search.

- 203, Distillation: Processes, Separatory, subclasses 1+ for a process directed to distilling, combined with measuring, testing or inspecting.
- 324, Electricity: Measuring and Testing, appropriate subclasses for a device for determining an appropriate physical characteristic of a material by electrical means.
- 361, Electricity: Electrical Systems and Devices, appropriate subclasses for electrical systems not otherwise classified and see "SEARCH CLASS" under the Class Definitions for various types of electrical systems.
- 374, Thermal Measuring and Testing, subclasses 100+ for a device for quantitatively determining temperature.
- 422, Chemical Apparatus and Process Disinfecting, Deodorizing, Preserving, or Sterilizing, subclasses 50+ for chemical apparatus for (a) determining quantitatively or qualitatively the presence of one or more chemical constituents of a material and (b) combination of a test or measurement means and means for regulating a chemical reaction.
- 436, Chemistry: Analytical and Immunological Testing, subclasses 1 through 183 for processes which quantitatively or qualitatively determine the presence of a chemical specie.

##### 2 WITH CLEANING OF APPARATUS:

This subclass is indented under the class definition. Processes including the step of cleaning the apparatus, e.g., removing adhering char product, etc.

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

- 39, for processes in which hot char is quenched as removed.

##### SEE OR SEARCH CLASS:

- 15, Brushing, Scrubbing, and General Cleaning, subclass 1.51 for a cleaning device including means to apply an electrostatic field to the foreign material to remove it, and subclasses 104.03+ for mechanical or gaseous pressure devices for removing deposits from conduits, pipes or tubes.

- 34, Drying and Gas or Vapor Contact With Solids, subclass 85 for gas or vapor contact with solids, apparatus with means for cleaning the apparatus.
- 122, Liquid Heaters and Vaporizers, subclasses 379+ for a boiler provided with a mechanism for cleaning the boiler.
- 134, Cleaning and Liquid Contact With Solids, subclasses 20 and 39 for a cleaning process for removing carbon.
- 165, Heat Exchange, subclass 5 for apparatus including a heat storing mass with a provision for cleaning the heat storing mass.
- 196, Mineral Oils: Apparatus, subclass 122 for a mineral oil vaporized provided with means for removing carbon from the vaporizer.
- 202, Distillation: Apparatus, subclass 241 for means for cleaning and decarbonizing distillation apparatus.
- 203, Distillation: Processes, Separatory, subclass 4 for a separatory distillation process combined with the step of removing a contaminant from the separatory apparatus.
- 208, Mineral Oils: Processes and Products, subclass 48 for a chemical conversion of hydrocarbon process including the step of removing solid deposits of carbon from the apparatus.
- 432, Heating, subclass 2 for a residual heating process including a step that purges, cleans or prevents accretion on the apparatus used.
- 510, Cleaning Compositions for Solid Surfaces, Auxiliary Compositions Therefor, or Processes of Preparing the Compositions, appropriate subclasses for claimed or solely disclosed (1) cleaning compositions for cleaning or removing foreign matter from solid surfaces, (2) auxiliary compositions for perfecting the cleaning compositions (e.g., rinse or dryer added fabric softener compositions), (3) compositions of this class defined in terms of specific structure, (4) packages of compositions of this class, and (5) processes of preparing compositions of this class, in each case where not provided for elsewhere; including those compositions (or appropriate methods) which are claimed or solely disclosed as specifically intended for such use.
- 2.5 NON-MINERAL DISTILLAND WITH CATALYST OR CHEMICAL TREATMENT OF VOLATILE COMPONENT:**  
This subclass is indented under the class definition. Processes in which the feedstock to the distillation process is a vegetable or animal material and which include either (1) use of a catalyst with distilland during the thermolysis, or (2) a chemical treatment of a volatile component, i.e., a distillate or a fixed gas obtained in the thermolysis, to convert or maintain a volatile component in a desired chemical form.
- (1) Note. Materials such as municipal wastes, garbage, sewage sludge, cellulose, etc., distillands suitable for placement in this subclass.
- (2) Note. The chemical treatment must include a chemical change, but it need not be a change in the product desired.
- (3) Note. Mere removal of water of hydration or mere conversion of a material to a carbon oxide (combustion) is not sufficient chemical treatment for this subclass.
- (4) Note. Mere recycle of products of the process, water, carbon oxides, hydrogen, etc., without a recitation of a specific chemical reaction due to the recycle is not sufficient for placement of a patent in this subclass.
- (5) Note. The catalyst must be more than the mere char product of the process.
- SEE OR SEARCH THIS CLASS, SUBCLASS:**
- 25, for processes in which nonwood, non-mineral material is used as a distilland.
- 45, for a collection of patents concerned with special procedures whereby a distillate of special characteristics may be obtained from a given distilland.

## SEE OR SEARCH CLASS:

585, Chemistry of Hydrocarbon Compounds, subclasses 240+ for the production of a hydrocarbon mixture from refuse or vegetation.

**3 WITH PHYSICAL SEPARATION OF SOLID BY-PRODUCT FROM REMOVED ADMIXTURE:**

This subclass is indented under the class definition. Processes including separating a solid by-product material by a disparate physical step.

## SEE OR SEARCH THIS CLASS, SUBCLASS:

28, for a process in which a solid product of a thermolytic process is removed, treated and recycled.

## SEE OR SEARCH CLASS:

203, Distillation: Processes, Separatory, subclasses 47+ for a separatory distillation process including the step of separating solid material.

209, Classifying, Separating, and Assorting Solids, appropriate subclasses for a process or apparatus for separating or segregating solid material according to a physical characteristic.

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

**4 Gas or vapor containing mixture:**

This subclass is indented under subclass 3. Processes in which a solid by-product is separated from a gas or vapor.

## SEE OR SEARCH CLASS:

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

137, Fluid Handling, subclasses 544+ for fluid handling apparatus including means for separating solid material from a fluid and see "SEARCH THIS CLASS, SUBCLASS" and

"SEARCH CLASS" under subclass 544 for related fields of search.

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

209, Classifying, Separating, and Assorting Solids, subclass 19 for a process of using free suspension in a gas for segregating solid components of a mixture.

**5 AND SHAPING TO DESIRED FORM OR CONFIGURATION:**

This subclass is indented under the class definition. Processes under the definition including a step of shaping solid carbonaceous material into a definite shape or structure.

(1) Note. For purposes of this subclass the recitation that the charge of carbonaceous material fills a container or a carbonizing zone is not shaping.

## SEE OR SEARCH THIS CLASS, SUBCLASS:

40, for a process of filling a carbonizing zone with carbonaceous material and compacting the material therein.

## 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.

249, Static Molds, appropriate subclass for a static molding implement.

264, Plastic and Nonmetallic Article Shaping or Treating: Processes, appropriate subclasses for a process of shaping plastic and nonmetallic articles and particularly subclasses 29.1+ wherein a carbonaceous material is subjected to a heat treatment in a substantially nonoxidizing atmosphere to produce a product containing elemental carbon. See Class 264, Plastic and Nonmetallic Article Shaping or Treating: Processes, section IA3 for the line.

425, Plastic Article or Earthenware Shaping or Treating: Apparatus, appropriate subclasses for molding machine to shape or reshape nonmetals.

**6 Prior to charging to carbonizing zone:**

This subclass is indented under subclass 5. Processes in which the shaping of the feed particles occurs prior to the step of charging them to the carbonizing zone.

**SEE OR SEARCH CLASS:**

264, Plastic and Nonmetallic Article Shaping or Treating: Processes, subclasses 29.1+ for a process of carbonizing a shaped preform.

**7 WITH COMMINUTING:**

This subclass is indented under the class definition. Processes combined with the step of comminuting or at least a portion of the charge or the residue.

**SEE OR SEARCH CLASS:**

241, Solid Material Comminution or Disintegration, subclasses 1 through 30, for a process directed to comminuting solid material.

264, Plastic and Nonmetallic Article Shaping or Treating: Processes, subclasses 500+ for a process of direct application of fluid pressure to shape the work and subclasses 239+ for a process of making a solid shape by the application of mechanical force.

**8 Prior to charging to carbonizing zone:**

This subclass is indented under subclass 7. Processes in which the solid carbonaceous material is disintegrated prior to charging to the carbonizing zone.

**9 AND SURFACE TREATING MATERIAL TO REDUCE OR PREVENT AGGLOMERATING OR FOAMING OR SWELLING DURING DISTILLATION:**

This subclass is indented under the class definition. Processes which include a treatment of the surface of the particles of the charge to reduce or prevent agglomerating or foaming or swelling during distillation.

(1) Note. Searing the surface of the feed particles to inhibit swelling during the car-

bonizing step is "Treating" within the purview of this subclass.

**SEE OR SEARCH CLASS:**

137, Fluid Handling, subclasses 170.1+ for apparatus for controlling the degree of foaming in a gas charged liquid.

264, Plastic and Nonmetallic Article Shaping or Treating: Processes, subclass 80 for a process of chemically decomposing a surface portion of a particle by heat.

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

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.

**10 BY CONDUCTION USING PREHEATED CHARGE CONTAINER OR PREHEATED INERT DISPARATE SOLID OR PREHEATED LIQUID:**

This subclass is indented under the class definition. Processes in which the distillation is brought about by heat derived by direct contact with an extraneous, preheated solid or liquid or container.

(1) Note. For purposes of this and indented subclasses a char is considered "an extraneous solid" unless it is disclosed as recycled solid product.

(2) Note. A preheated coke oven is a preheated container within the meaning of this subclass if it contains originally enough heat to completely carbonize the charge.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 20, for a process in which a solid or liquid noncarbonaceous substance is included in the material to be carbonized and subclass 28 for a continuous process in which a recovered product of the carbonization step is recycled.

SEE OR SEARCH CLASS:

- 165, Heat Exchange, subclasses 104.11+, for apparatus in which a retained body of fluent material forming a part of the apparatus, acts as a heat storer or heat carrier for the apparatus.
- 202, Distillation: Apparatus, subclass 219 for distillation apparatus in which the retort contains a mass of fusible substance through which the heat is conveyed to the retort.
- 588, Hazardous or Toxic Waste Destruction or Containment, subclass 314 and 321 for the use of preheated inert disparate solid or preheated liquid to destroy hazardous waste.

#### 11 **Liquid is metal:**

This subclass is indented under subclass 10. Processes in which the preheated material is molten metal.

SEE OR SEARCH CLASS:

- 34, Drying and Gas or Vapor Contact With Solids, subclasses 329+, for a process including contacting the material being treated with a liquid metal, and see notes thereunder for related fields of search.
- 48, Gas: Heating and Illuminating, subclass 92 for a retort containing heated molten metal into which material to be gasified is injected.
- 165, Heat Exchange, subclasses 104.11+ for apparatus in which a retained body of fluent material forming a part of the apparatus, acts as a heat storer or heat carrier for the apparatus.

#### 12 **Particulate disparate solid:**

This subclass is indented under subclass 10. Processes in which the preheated material is a particulate solid.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 22, for a process in which char is incorporated in the material to be carbonized.
- 28, for a process in which a hot, solid product of the carbonization step is recycled to the carbonizing operation.

SEE OR SEARCH CLASS:

- 208, Mineral Oils: Processes and Products, subclasses 126+ for a process directed to adding hot solids to a mineral oil and note "SEARCH THIS CLASS, SUBCLASS" and "SEARCH CLASS" under subclass 126.

#### 13 **USING A CARBONIZATION PRODUCT AS INDIRECT HEAT SOURCE:**

This subclass is indented under the class definition. Processes including using a product of the carbonizing step as an indirect source of heat.

- (1) Note. A hot product of the thermolytic distillation process may be utilized as such as an indirect source of heat or further treated before recovering the heat therefrom by indirect heat exchange.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 28+, for a process in which heat is incidently and directly recovered by recirculating a hot product of the carbonizing step to the carbonizing zone.

SEE OR SEARCH CLASS:

- 34, Drying and Gas or Vapor Contact With Solids, subclass 513 for a process including conserving heat by indirect heat exchange.
- 165, Heat Exchange, subclasses 4+ for a device for alternately heating a mass with a fluid and then heating a second fluid with the stored heat.
- 196, Mineral Oils: Apparatus, subclass 134 for apparatus for vaporizing mineral oils including means for heat recovery from the vapor or residuum.
- 202, Distillation: Apparatus, subclass 146 for a horizontal retort with flues wherein the air and/or gas combustion

is heated by the waste products of combustion by means of a single-surface heater and subclass 150 for a similar apparatus using a double surface heater.

- 203, Distillation: Processes, Separatory, subclasses 21+ for a process of distilling a liquid in which heat is recovered by indirect heat exchange.
- 237, Heating Systems, appropriate subclass, for a heating system which may use the heat rejected portion of a refrigeration system with additional heating means.
- 588, Hazardous or Toxic Waste Destruction or Containment, subclasses 313 through 321 for the use of a carbonization product as an indirect heat source to destroy hazardous or toxic waste.

**14 For heating the carbonaceous material:**

This subclass is indented under subclass 13. Processes directed to indirectly heating the carbonaceous charge, at least in part, with heat from a product of the thermolytic distillation operation.

**SEE OR SEARCH CLASS:**

- 196, Mineral Oils: Apparatus, subclass 134 for a mineral oil vaporizer having means for preheating the incoming oil by the heat of the vapors or residue.
- 203, Distillation: Processes, Separatory, subclasses 22+ and 25+ for a process of distilling a liquid in which the heat recovered by indirect heat exchange is used to heat the incoming feed or the distillation zone.

**15 Including heat by burning of product:**

This subclass is indented under subclass 14. Processes directed to indirectly heating the carbonaceous charge, at least in part, by the burning of at least a part of a product of the thermolytic distillation operation.

- (1) Note. When the cracking of a vapor product is for the production of heat to assist the thermolytic process and not primarily to produce a mineral oil, the process is classified in Class 201 instead of Class 208.

**SEE OR SEARCH CLASS:**

- 34, Drying and Gas or Vapor Contact With Solids, subclass 513, for a process including conserving heat by burning the discharged vapors and using the evolved heat.
- 202, Distillation: Apparatus, subclasses 111, 122, 123, 130, 132, 140, 141+, 146, and 148 for retort system heated by the heat carried off by the products of combustion.

**16 Solid product:**

This subclass is indented under subclass 15. Processes in which the carbonaceous charge is indirectly heated, at least in part, by burning a solid product of the thermolytic distillation operation.

**17 AND REFINING CHAR, E.G., DESULFURIZING COKE:**

This subclass is indented under the class definition. Processes combined with the step of removing impurities from char.

**SEE OR SEARCH CLASS:**

- 423, Chemistry of Inorganic Compounds, subclasses 449.1+ for processes for producing carbon by a chemical reaction, e.g., oxidation, etc.
- 502, Catalyst, Solid Sorbent, or Support Therefor: Product or Process of Making, especially subclasses 174+ and 416+ for a catalyst or sorbent containing carbonized material or process of making such composition.

**18 UTILIZING APPARATUS OF PARTICULAR COMPOSITION:**

This subclass is indented under the class definition. Processes directed to using structures having a specific composition, (e.g., a cast iron sole plate, etc.).

**SEE OR SEARCH CLASS:**

- 203, Distillation: Processes, Separatory, subclass 86 for a process of distilling directed to the use of an apparatus or element of specific composition.

- 264, Plastic and Nonmetallic Article Shaping or Treating: Processes, subclass 30 for forming or repairing furnace linings and see "Search Class" thereunder for related fields of search.
- 266, Metallurgical Apparatus, subclasses 280+ for the lining construction for metallurgical receptacles.
- 373, Industrial Electric Heating Furnaces, subclasses 137, 155 and 164 for an electric furnace having a lining of a specific composition.
- 501, Compositions: Ceramic, subclasses 94+ for refractory compositions useful in making refractory linings.

**19 APPLYING ELECTRICAL ENERGY DIRECTLY TO MATERIAL:**

This subclass is indented under the class definition. Processes including applying electrical energy directly to the material undergoing treatment.

**SEE OR SEARCH CLASS:**

- 196, Mineral Oils: Apparatus, subclasses 120+ for mineral oil vaporizing apparatus having special means for heating.
- 209, Classifying, Separating, and Assorting Solids, subclasses 127.1+, for a process of applying an electrostatic charge for assorting solid material.
- 219, Electric Heating, appropriate subclasses for electric heating devices and electrical heating processes. See also under "SEARCH CLASS" references to related fields utilizing electrical heating.
- 264, Plastic and Nonmetallic Article Shaping or Treating: Processes, subclasses 405+ for a process directed to applying electrical or wave energy directly to the work.
- 423, Chemistry of Inorganic Compounds, subclasses 449.1+ for processes for producing carbon by a chemical reaction, e.g., oxidation, etc.
- 588, Hazardous or Toxic Waste Destruction or Containment, subclasses 302 through 303 for the use of electrical energy in the destruction of hazardous or toxic waste.

**20 ADDING DISPARATE NON-GASEOUS MATERIAL TO FEED:**

This subclass is indented under the class definition. Processes directed to incorporating an extraneous, solid or liquid, noncarbonaceous material into the carbonaceous material being treated.

**SEE OR SEARCH CLASS:**

- 202, Distillation: Apparatus, subclass 176 for separatory distillation apparatus including a distilland treating device.
- 203, Distillation: Processes, Separatory, subclasses 29+ for a distillation process directed to adding a material which reacts with a component of the mixture.
- 588, Hazardous or Toxic Waste Destruction or Containment, subclasses 313 through 320 for using an added substance to destroy hazardous or toxic waste.

**21 FEED OF TWO OR MORE CARBONACEOUS MATERIAL (AT LEAST THE PREDOMINATE ONE BEING SOLID):**

This subclass is indented under the class definition. Processes in which the feed material is composed of two or more carbonaceous substances of which at least the predominate one is a solid.

- (1) Note. For purposes of this and indented subclasses, garbage and waste material which is carbonized is considered a mixture unless the disclosure specifically states that it is not.
- (2) Note. For purposes of this and indented subclasses wood, oil shale or a particular type of coal is considered a distinct material.
- (3) Note. For purposes of this and indented subclasses a charge of a mixture of two distinct sizes of particles is considered a mixture, e.g., a charge consisting of wood blocks and sawdust.

## 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.
- 110, Furnaces, subclass 235 for furnaces for incinerating garbage.
- 252, Compositions, subclasses 502+ for electrically conductive compositions containing carbon which compositions have been carbonized.
- 313, Electric Lamp and Discharge Devices, subclasses 326+ for electrodes for electric lamps and electric discharge devices defined by their structure.
- 373, Industrial Electric Heating Furnaces, subclasses 88+ for the composition of electric arc furnace electrodes.

**22****Char containing:**

This subclass is indented under subclass 21. Processes in which a component of the feed is char.

## SEE OR SEARCH THIS CLASS, SUBCLASS:

- 28+, for processes in which a char product is recycled to the carbonizing operation.

**23****Mineral oil containing:**

This subclass is indented under subclass 21. Processes in which the feed contains mineral oil.

- (1) Note. See Class 208, Mineral Oils: Processes and Products, "Definition of Terms," for the scope of the term "mineral oil".

## SEE OR SEARCH THIS CLASS, SUBCLASS:

- 29, for a process in which an oil recovered from the carbonization step is recycled to the carbonization zone.

## SEE OR SEARCH CLASS:

- 48, Gas: Heating and Illuminating, subclass 201 for a process of gasifying a mixture of coal and oil.

**24****Coals only:**

This subclass is indented under subclass 21. Processes in which the feed is a mixture of coal materials.

- (1) Note. This subclass includes a feed comprising a mixture of two or more different coals. It also includes a feed of a mixture two or more specific sizes of coal particles, e.g., a mixture of 4-inch lumps and 1/2-inch lumps.

**25****FEED OTHER THAN COAL, OIL SHALE OR WOOD:**

This subclass is indented under the class definition. Processes in which the feed is a solid carbonaceous material other than coal, oil shale or wood.

- (1) Note. Corn cobs, peat and straw are examples of solid carbonaceous material within the scope of this subclass.
- (2) Note. For purposes of this subclass the term "coal" includes anthracite, all bituminous coals and all lignites.
- (3) Note. For purposes of this subclass the term "wood" includes wood of any type whether in large pieces or as sawdust.
- (4) Note. For purposes of this subclass the term "oil shale" includes tar sands.

## SEE OR SEARCH CLASS:

- 44, Fuel and Related Compositions, subclasses 490+ for peat briquettes and processes for preparing peat for fuel, especially subclass 492 for a process for wet carbonizing peat

**26****IN PARALLEL STAGES SIMULTANEOUSLY:**

This subclass is indented under the class definition. Processes wherein a plurality of solid carbonaceous materials are separately and simultaneously subjected to carbonizing conditions.

- (1) Note. To come within the purview of this subclass a plurality of distinct carbonaceous charges are thermolytically treated substantially simultaneously in separate and distinct isolated zones.

SEE OR SEARCH CLASS:

- 34, Drying and Gas or Vapor Contact With Solids, subclass 113 for a combination of a plurality of interconnected rotating treating drums.
- 110, Furnaces, subclass 208 for a plurality of interconnected furnaces in which the gases from one furnace are passed into an associated furnace.
- 202, Distillation: Apparatus, subclass 113 for a plurality of retorts connected in series or parallel.

**27 INCLUDING BURNING OF VAPORIZED PRODUCT:**

This subclass is indented under the class definition. Processes in which a volatile product of the carbonization step is burned.

SEE OR SEARCH CLASS:

- 588, Hazardous or Toxic Waste Destruction or Containment, subclasses 313 through 320 for the burning of the vaporized product.

**28 SEQUENTIALLY REMOVING, TREATING AND RECYCLING A PRODUCT:**

This subclass is indented under the class definition. Processes directed to treating a product of the carbonizing step and recycling to the carbonizing process at least a part of the so treated product.

- (1) Note. The product recycled may be a solid or a liquid or a gas.
- (2) Note. The product of the carbonization step may or may not have been altered after it was removed from the carbonizing zone.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 13+, for processes in which the heat of a product of carbonization is recovered by indirect heat exchange.

**29 Removing and treating vapor:**

This subclass is indented under subclass 28. Processes in which the product which is recycled is a volatile.

SEE OR SEARCH CLASS:

- 196, Mineral Oils: Apparatus, subclass 99, for mineral oil distilling apparatus including the combination of a vaporizer, condensing means with means for returning a part or all of the condensate to the vaporizer.
- 202, Distillation: Apparatus, subclass 109, for apparatus for moving the volatile matter distilled off in a closed circuit through the retort.

**30 AND FRACTIONALLY CONDENSING VAPORS:**

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

- (1) Note. The vapor must be removed from the carbonizing zone and condensed in a plurality of zones having distinct temperatures.

SEE OR SEARCH CLASS:

- 202, Distillation: Apparatus, subclass 199 for apparatus in which vapor is passed through a condensate from itself to surrender high-boiling constituents.
- 203, Distillation: Processes, Separatory, subclass 87 for a process directed to fractionally condensing the vapor outside the still and see "SEARCH CLASS" thereunder.

**31 FLUIDIZED BED:**

This subclass is indented under the class definition. Processes directed to carbonizing the carbonaceous material in a fluidized bed.

- (1) Note. Fluidized bed for purposes of this subclass is a system in which an upwardly flowing gas maintains the particles of the charge in an agitated, more or less suspended condition during carbonization. Arbitrarily a process including hindered fall of particles during

carbonization by means of an upwardly flowing gas is included in this subclass.

**SEE OR SEARCH CLASS:**

- 34, Drying and Gas or Vapor Contact With Solids, subclass 359 for a process of treating a solid in gas or vapor suspension.
- 208, Mineral Oils: Processes and Products, subclasses 126+ for a process directed to adding hot solids to a mineral oil and note "SEARCH THIS CLASS, SUBCLASS" and "SEARCH CLASS" under subclasses 126 and 127.

**32 IN A MOVING BED:**

This subclass is indented under the class definition. Processes in which carbonizing is carried out on a charge of carbonaceous material which is in motion with respect to the carbonizing zone.

- (1) Note. For purposes of this and indented subclasses the individual particles of a charge may be in motion with respect to each other and the carbonization zone or a confined charge may be moving with respect to the carbonization zone.

**SEE OR SEARCH CLASS:**

- 202, Distillation: Apparatus, subclass 117 for apparatus having means for moving the distilland through it, and note "Search This Class, Subclass" under subclasses 117+ for other apparatus in which the distilland passes through the retort.
- 373, Industrial Electric Heating Furnaces, subclasses 84 and 85+ for a rotating electric arc furnace.

**33 Agitating:**

This subclass is indented under subclass 32. Processes directed to positively agitating the charge in the carbonizing zone.

**SEE OR SEARCH CLASS:**

- 34, Drying and Gas or Vapor Contact With Solids, subclasses 114+ and 122 for a rotating retort with means for gas or vapor contact with the treated material.

- 198, Conveyors: Power-Driven, subclasses 467.1, 513, 545, 548, 550.1, 608, 611+, 468.1, 625, 657+ for a screw conveyor, subclasses 409, 429+, 517, 602, 614, 621.1+, 736+, and 750.1+ for a reciprocating conveyor, and subclasses 441+, 450, 550.6, 608, 611+ for a rotary conveyor.
- 202, Distillation: Apparatus, subclasses 118, 131, 136, 216, 218, 238, and 265, for distillation apparatus including a rotating retort or agitating elements and see "SEARCH CLASS" under subclasses 218 and 265.
- 366, Agitating, subclasses 219+ for a mixing chamber which moves, in whole or in part, to effect agitation; also the corresponding method.

**34 Gravitating:**

This subclass is indented under subclass 32. Processes directed to carbonizing a gravitating charge of carbonaceous material in the carbonizing zone.

**SEE OR SEARCH CLASS:**

- 202, Distillation: Apparatus, subclasses 120+ for apparatus in which the distilland passes through it in a vertical direction.

**35 CARBONIZING UNDER PNEUMATIC PRESSURE OR VACUUM:**

This subclass is indented under the class definition. Processes directed to carbonizing under pneumatic pressure or vacuum.

- (1) Note. For purposes of this subclass the claims must clearly state that the pneumatic pressure in the carbonizing zone materially differs from ambient pressure.
- (2) Note. Processes directed to carbonizing in which the charge is only subjected to container wall pressure are excluded.

**SEE OR SEARCH CLASS:**

- 34, Drying and Gas or Vapor Contact With Solids, subclasses 402+ for a process of treating a solid under vacuum or applying gas or vapor under superatmospheric pressure.

- 202, Distillation: Apparatus, subclass 110 for thermolytic distillation apparatus in which the distilland is under pressure.
- 203, Distillation: Processes, Separatory, subclasses 73+ and 91+ for a distillation process in which the distillation zone is under pressure or vacuum.
- 588, Hazardous or Toxic Waste Destruction or Containment, subclass 321 for carbonizing, which may include treating under pressure or a vacuum to destroy hazardous or toxic waste.
- 36 AND ADDING DISPARATE GASEOUS MATERIAL TO THE CARBONIZING ZONE:**  
This subclass is indented under the class definition. Processes directed to positively adding an extraneous gaseous material to the solid carbonaceous material being acted upon.
- SEE OR SEARCH CLASS:
- 34, Drying and Gas or Vapor Contact With Solids, subclasses 282+ for a process for contacting a solid with a gas or vapor to remove moisture or other vaporizable components and subclasses 114+ and 122 for a rotating retort with means for gas or vapor contact with the treated material.
- 202, Distillation: Apparatus, subclass 121 for a retort provided with means for injection of fluid, and see (1) Note and "(2) Search Class" thereunder for other apparatus in which fluid is injected.
- 208, Mineral Oils: Processes and Products, subclasses 126+ for a process directed to adding hot solids to a mineral oil and note "SEARCH THIS CLASS, SUBCLASS" and "SEARCH CLASS" under subclass 126.
- 502, Catalyst, Solid Sorbent, or Support Therefor: Product or Process of Making, especially subclasses 174+ and 416+ for a catalyst or sorbent containing carbonized material or a process of making such composition.
- 588, Hazardous or Toxic Waste Destruction or Containment, subclass 312 and 313-320 for the use of gaseous material in a process for destroying hazardous or toxic waste.
- 37 Combustion gases:**  
This subclass is indented under subclass 36. Processes in which the extraneous gaseous material includes combustion gases.
- SEE OR SEARCH CLASS:
- 34, Drying and Gas or Vapor Contact With Solids, subclasses 443+ for a process of treating solid material with the products of combustion.
- 202, Distillation: Apparatus, subclasses 111, 121, 123, 130, 132, 140, 141+, 146, and 148 for a retort system heated by the heat carried off by the products of combustion.
- 38 Steam containing:**  
This subclass is indented under subclass 36. Processes in which the extraneous gaseous material includes steam.
- SEE OR SEARCH CLASS:
- 48, Gas: Heating and Illuminating, subclasses 200, 202 and 204+, for a process of gasifying fuel in which steam is injected into the incandescent fuel.
- 110, Furnaces, subclasses 188+, 199+, 296, and 297+ for means of feeding air and steam to a furnace.
- 39 QUENCHING CHAR WITH AN INERT MATERIAL:**  
This subclass is indented under the class definition. Processes directed to cooling the carbonaceous residue of the process by quenching in an inert medium.
- (1) Note. A liquid or gas which does not materially react with the hot carbonaceous residue is considered inert.
- SEE OR SEARCH CLASS:
- 202, Distillation: Apparatus, subclass 95 for apparatus including a device for cooling the residue, subclasses 227+ for distillation apparatus including a quencher and see under subclass 227 "SEARCH THIS CLASS, SUBCLASS" and "SEARCH CLASS" for related fields of search.

**40 ARRANGING THE CARBONACEOUS MATERIAL IN THE CARBONIZING ZONE:**

This subclass is indented under the class definition. Processes including arranging or positioning the carbonaceous material in the retort to facilitate carbonizing it or to facilitate removing products.

- (1) Note. The broad recitation that gas is removed during charging does not take the process out of this subclass.

**SEE OR SEARCH CLASS:**

- 34, Drying and Gas or Vapor Contact With Solids, subclass 518 for a process of arranging the solid material to promote contact with gas or vapor passing therethrough.
- 202, Distillation: Apparatus, subclass 263 for thermolytic distillation apparatus provided with means for disposing of smoke and fumes produced while charging.
- 414, Material or Article Handling, subclass 133 for apparatus for forming piles of coal or like material; also, subclasses 147+ or 586+ for the combination, or subcombination, respectively, of a chamber of a type utilized for a heating function and means for moving material to, into, within, out of, or from the chamber.

**41 MISCELLANEOUS:**

This subclass is indented under the class definition. Processes directed to thermolytically decomposing solid, carbonaceous material by applying heat not otherwise provided for.

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

**SEE OR SEARCH CLASS:**

- 423, Chemistry of Inorganic Compounds, subclasses 449.1 through 449.9 for processes for producing carbon by a chemical reaction, e.g. oxidation, etc.

**CROSS-REFERENCE ART COLLECTIONS**

The following subclasses represent at least a substantial

collection of patents found elsewhere in the classification of this class, but merit isolation for aid in searching certain concepts which do not form appropriate bases for the placement of original patents. These concepts are as given in the titles and definitions of the subclasses listed hereunder.

The cross-reference patents contained in these collections may be of further assistance to the searcher, either as a starting point in searching this class or as an indication of further related fields of search inside or outside the class. Thus, there is here provided a further path of access for retrieval of a limited number of types of disclosure.

- (1) Note. Disclosure are placed in these subclasses for their value as references and as leads to appropriate main or secondary fields of search, without regard to their original classification or their claimed subject matter.

- (2) Note. The disclosures found in the following subclasses are examples, only, of the indicated subject matter, and in no instance do they represent the entire extent of the prior art.

**42 PARTICLE SIZE:**

This subclass is indented under the class definition. Thermolytic processes as provided for in this class wherein there is either recited or disclosed a reference to a particular size or dimension of the particles of at least one component of the material being acted upon.

**SEE OR SEARCH CLASS:**

- 44, Fuel and Related Compositions, subclasses 500+ for a particulate solid fuel composition and subclasses 550+ for a consolidated fuel solids compositions.
- 149, Explosive and Thermic Compositions or Charges, subclasses 110+ for a collection of patents based on the particle size of a component of an explosive or thermic composition.

**43 AN EXTRANEOUS, CYCLICALLY CIRCULATED, INERT HEATING GAS:**

This subclass is indented under the class definition. Thermolytic processes as provided for in this class in which the charge is heated by

means of a hot, extraneous, inert gas cyclicly circulated.

**SEE OR SEARCH CLASS:**

- 162, Paper Making and Fiber Liberation, subclasses 41+ for a process of fiber liberation including circulating a hot digesting fluid through the digester and subclasses 248+ for a fiber liberation digester having means to circulate the digesting fluid.
- 202, Distillation: Apparatus, subclass 109 for apparatus for moving the volatile matter distilled off in a closed circuit through the retort.

**44 PLURAL DISTINCT TEMPERATURE STAGES:**

This subclass is indented under the class definition. Thermolytic processes as provided for in this class in which the carbonaceous material is subjected to at least two distinctly different temperature stages.

**SEE OR SEARCH CLASS:**

- 202, Distillation: Apparatus, subclasses 150, 159 and 177+ for distillation apparatus including a preheating device.
- 203, Distillation: Processes, Separatory, subclasses 71+ for plural separatory distillation steps.
- 208, Mineral Oils: Processes and Products, subclasses 49+, 354+ and 364+ for a process directed to heating mineral oil at distinct temperature stages.

**45 DISTILLATE TREATMENT OR CONSERVATION:**

This subclass is indented under the class definition. Thermolytic processes involving special characteristics may be obtained from a given distilland.

END