

**CLASS 159, CONCENTRATING EVAPORATORS****SECTION I - CLASS DEFINITION**

This class relates to apparatus and processes, which are not more specifically provided for elsewhere, peculiar to the concentration of solids held in solution or suspension, by evaporation of the liquid containing them in solution or suspension, and the recovery of the concentrate. The concentration may be carried to the point of crystallization or to dryness.

**SECTION II - NOTES TO THE CLASS DEFINITION**

- (1) Note. Processes involving significant chemical changes are excluded.
- (2) Note. Machines, processes, and treatments of a specialized character (e.g., heat treatments) directed to the preparation or purification of a particular substance, which are not simply a mode or means of concentrating by evaporation, of general application are excluded. However, processes and apparatus solely for concentrating by evaporation are here even though the particular material concentrated is specified.
- (3) Note. Evaporating apparatus involving the recovery or treatment of the vapors evolved either as vapors or condensate (e.g., stills) is excluded. This does not exclude the recovery of heat in the vapors.

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

This class is superior to Class 165, Heat Exchange, in that means for the transfer of heat for the specific purpose of concentration by evaporation is found here. This class is superior to Class 122, Liquid Heaters and Vaporizers, in that means for vaporizing liquid for the specific purpose of concentration of attendant solids is found here. This class is superior to Class 261, Gas and Liquid Contact Apparatus, in that means for contacting gas and liquid for the specific purpose of concentration by evaporation is found here. This class is differentiated from Class 34, Drying and Gas or Vapor Contact With Solids, in that the substance under treatment is initially in a liquid or fluent condition.

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

- 23, Chemistry: Physical Processes, subclasses 295+ for processes involving purification of salt or separation of different salts, but where merely the evaporation and concentration of a saline solution with attendant crystallization is concerned, the patents are found here.
- 62, Refrigeration, subclasses 123+ and 532+ for separation of a constituent of a liquid mixture by refrigeration.
- 117, Single-Crystal, Oriented-Crystal, and Epitaxy Growth Processes; Non-Coating Apparatus Therefor, appropriate subclasses for processes and non-coating apparatus for growing therein-defined single-crystal of all types of materials, including use of or means including a concentrating evaporator.
- 126, Stoves and Furnaces, appropriate subclasses for open water heaters having no structure specially directed to the concentration of the solids in solution or suspension.
- 422, Chemical Apparatus and Process Disinfecting, Deodorizing, Preserving, or Sterilizing, subclasses 198+ and 285+ for concentrating apparatus for that class.

**SUBCLASSES****1.1 MISCELLANEOUS:**

This subclass is indented under the class definition. Subject matter not provided for below or elsewhere.

**2.1 SUPERHEATING AND PRESSURE RELEASE:**

This subclass is indented under the class definition. Apparatus comprising a closed vessel adapted to heat a liquid, but to maintain sufficient ebullition in communication with a space of less pressure into which the heated liquid is discharged to cause evaporation.

**SEE OR SEARCH CLASS:**

- 122, Liquid Heaters and Vaporizers, subclass 40 for boilers in which liquid is flashed into steam.

- 2.2 With extruder:**  
This subclass is indented under subclass 2.1. Apparatus having means to force or press out the material being concentrated.
- 2.3 Multistage:**  
This subclass is indented under subclass 2.1. Apparatus functioning in plural operations.
- 3 SPRAY TYPE:**  
This subclass is indented under the class definition. Apparatus comprising means to spray a liquid in combination with a collecting chamber or receptacle.
- SEE OR SEARCH CLASS:  
202, Distillation: Apparatus, subclass 236 for a still having means for introducing the distilland in the form of a spray.  
203, Distillation: Processes, Separatory, subclass 90 for a process of introducing the distilland into the vaporization zone in the form of a spray.  
239, Fluid Sprinkling, Spraying, and Diffusing, appropriate subclasses for spraying devices, per se.
- 4.01 Gaseous current:**  
This subclass is indented under subclass 3. Apparatus provided with means for directing a gaseous current through the spray or spray chamber.
- SEE OR SEARCH CLASS:  
34, Drying and Gas or Vapor Contact With Solids, subclasses 359 and 576+ for processes and apparatus which employ a fluid current to move the material being worked upon.  
62, Refrigeration, subclasses 74 and 347 for refrigeration processes in which the raw material is sprayed or dripped.  
261, Gas and Liquid Contact Apparatus, subclasses 75+ for liquids sprayed into contact with gases.  
422, Chemical Apparatus and Process Disinfecting, Deodorizing, Preserving, or Sterilizing, subclass 289 for concentrating evaporator specialized to chemistry in which hot gases, etc., are contacted with liquids.
- 4.02 Combustion product gas:**  
This subclass is indented under subclass 4.01. Apparatus wherein the gaseous current is a product of a combustible gas.
- 4.03 Antibridging:**  
This subclass is indented under subclass 4.01. Apparatus for preventing buildup of solids on the evaporator wall or the inlet or outlet of the same.
- 4.04 Countercurrent:**  
This subclass is indented under subclass 4.01. Apparatus for providing a gas flow counter to that of the spray.
- 4.05 Intermediate gas outlet or inlet:**  
This subclass is indented under subclass 4.01. Apparatus having either an inlet or outlet located approximately on the axial center of the evaporator.
- 4.06 Bottom sprayer:**  
This subclass is indented under subclass 4.01. Apparatus wherein the sprayer is located on or near the bottom of the apparatus and the liquid is sprayed upwardly.
- 4.07 Horizontal sprayer:**  
This subclass is indented under subclass 4.01. Apparatus with means spraying the liquid on an horizontal plane.
- 4.08 Impinging jets:**  
This subclass is indented under subclass 4.01. Apparatus wherein the liquid is introduced in several jets which impinge each other.
- 4.09 Multistaging:**  
This subclass is indented under subclass 4.01. Apparatus for carrying out the spraying in plural operations.
- 4.1 Heat recovery:**  
This subclass is indented under subclass 4.01. Apparatus with means to recover heat.
- 4.2 Spinning sprayer:**  
This subclass is indented under subclass 4.01. Apparatus wherein the sprayer rotates.

- 4.3 Rotary drum with sprayer:**  
This subclass is indented under subclass 4.01. Apparatus with a revolving drum having spray means.
- 4.4 Steam drying or atomizing:**  
This subclass is indented under subclass 4.01. Apparatus using steam to dry or atomize.
- 5 FILM TYPE:**  
This subclass is indented under the class definition. Apparatus especially designed to evaporate a liquid in film or thin layer form.
- SEE OR SEARCH CLASS:
- 118, Coating Apparatus, appropriate subclasses for apparatus for applying liquid coating material to work.
- 202, Distillation: Apparatus, subclass 236 for a still in which the distilland to be vaporized is in a thin film.
- 203, Distillation: Processes, Separatory, subclasses 72 and 89 for a process of introducing the distilland into the vaporization zone by spreading it in a thin film over a surface.
- 454, Ventilation, subclasses 110, 157, 223, 291, 328, and 337 for air-moistening attachments for registers.
- 6.1 Centrifugal:**  
This subclass is indented under subclass 5. Apparatus in which the liquid is maintained as a film on a supporting surface by means of centrifugal force.
- SEE OR SEARCH CLASS:
- 118, Coating Apparatus, subclasses 52+ for coating apparatus having means to centrifuge the work.
- 165, Heat Exchange, subclasses 86+ for a heat exchanger having a movable tempering surface.
- 261, Gas and Liquid Contact Apparatus, subclass 85 for gas and liquid contact apparatus comprising rotating hollow cylinders.
- 6.2 Wiped film:**  
This subclass is indented under subclass 6.1. Apparatus wherein means contact the film adjacently to its flow.
- 6.3 Horizontally:**  
This subclass is indented under subclass 6.2. Apparatus wherein means contact the film in a horizontal direction.
- 7 Moving-film support:**  
This subclass is indented under subclass 5. Apparatus in which the film is spread or supported on a traveling surface for evaporation.
- SEE OR SEARCH CLASS:
- 34, Drying and Gas or Vapor Contact With Solids, appropriate subclasses for driers of the endless carrier or rotary type.
- 165, Heat Exchange, subclasses 86+ for a movable heat exchange surface not specialized to the evaporation of liquid.
- 425, Plastic Article or Earthenware Shaping or Treating: Apparatus, subclass 223 for a flake-forming apparatus comprising means for casting a film on a moving endless surface and a means to remove the hardened film as flakes.
- 8 Gaseous current:**  
This subclass is indented under subclass 7. Apparatus in which a gaseous current is directed against or in proximity to the surface of the film on the moving support.
- SEE OR SEARCH CLASS:
- 261, Gas and Liquid Contact Apparatus, subclass 80 for gas and liquid contact comprising endless belts.
- 9.1 Rotary drum or disk:**  
This subclass is indented under subclass 8. Apparatus in which the moving support carrying the film is a rotary drum or disk.
- SEE OR SEARCH CLASS:
- 261, Gas and Liquid Contact Apparatus, subclasses 83+ for contact devices having a rotary movement.
- 9.2 Treated material inside drum:**  
This subclass is indented under subclass 9.1. Apparatus in which the rotary drum supports the film interior thereof.

- 10 Exterior surface:**  
This subclass is indented under subclass 9.1. Apparatus in which the rotary drum or disk supports the film on its exterior surface.
- SEE OR SEARCH CLASS:  
261, Gas and Liquid Contact Apparatus, subclasses 91+ for rotating impellers arranged to dip in liquid to effect gas and liquid contact.
- 11.1 Rotary drum or disk:**  
This subclass is indented under subclass 5. Apparatus in which the moving film support is a rotary drum or disk.
- SEE OR SEARCH CLASS:  
34, Drying and Gas or Vapor Contact With Solids, subclasses 108+ for apparatus including a hollow drum rotating about an axis through, over, by, or in which the material is carried to be treated, and subclass 173 for apparatus of the gravity-flow type with shelf to shelf or zigzag treated material flow in which there is a rotary shelf or stirrer.  
165, Heat Exchange, subclasses 89+ for a heated or cooled rotary drum not specialized to evaporation.  
492, Roll or Roller, appropriate subclasses for a roll, per se, not elsewhere provided for, and see the notes thereunder.
- 11.2 Internal film:**  
This subclass is indented under subclass 11.1. Apparatus wherein the film contacts the internal surface of the drum or disk.
- 11.3 Rotary disk:**  
This subclass is indented under subclass 11.2. Apparatus consisting of a revolving disk.
- 12 Inclosing chamber:**  
This subclass is indented under subclass 11.1. Apparatus in which the traveling surface is enclosed in a chamber.
- 13.1 Moving film:**  
This subclass is indented under subclass 5. Apparatus adapted to maintain the liquid to be concentrated in a moving film.
- SEE OR SEARCH CLASS:  
122, Liquid Heaters and Vaporizers, subclass 39 for boilers in which liquid flows over the heating surface in a thin stream.  
165, Heat Exchange, subclasses 115+ for a trickler-type heat exchanger of general utility.  
261, Gas and Liquid Contact Apparatus, subclasses 75+ for devices for contact gases and liquids.
- 13.2 Contacting tube:**  
This subclass is indented under subclass 13.1. Apparatus wherein the film comes in contact with a tube.
- 13.3 Outside of tube:**  
This subclass is indented under subclass 13.2. Apparatus wherein the film contacts the outer portion of the tube.
- 13.4 With gas wiping:**  
This subclass is indented under subclass 13.1. Apparatus having means for injected vapor or generated vapor to flow adjacent the film and relative thereto.
- 14 Climbing:**  
This subclass is indented under subclass 13.1. Apparatus in which the moving film ascends.
- SEE OR SEARCH CLASS:  
122, Liquid Heaters and Vaporizers, subclass 34 for devices in which the fluid is indirectly heated by another separate fluid and including an internal separator.
- 15 Zigzag:**  
This subclass is indented under subclass 13.1. Apparatus in which the film follows a zigzag path.
- SEE OR SEARCH CLASS:  
34, Drying and Gas or Vapor Contact With Solids, subclasses 165+, particularly subclasses 171+ and 178 for apparatus of the gravity-flow type with shelf to shelf or zigzag treated material flow.  
122, Liquid Heaters and Vaporizers, subclass 355 for zigzag water tubes.

- 165, Heat Exchange, subclass 116 for a trickler of the shelf to shelf type of general utility.
- 261, Gas and Liquid Contact Apparatus, subclasses 127+ for contact fluids heated through the medium of other fluids out of contact therewith, and subclasses 108+ for contact apparatus including stationary baffles over which liquid flows in contact with gases.
- 16.1 GASEOUS BLAST OR CURRENT:**  
This subclass is indented under the class definition. Apparatus designed to pass a current of air or moisture-absorbing gas over or through a body or liquid.
- SEE OR SEARCH CLASS:
- 62, Refrigeration, subclasses 304+ for a gas-liquid contact cooler cooling material out of contact with the contacting fluids.
- 126, Stoves and Furnaces, subclass 113 for air moisteners in connection with hot air furnaces.
- 422, Chemical Apparatus and Process Disinfecting, Deodorizing, Preserving, or Sterilizing, subclass 290 for concentrating apparatus specialized to chemistry with similar heating means.
- 16.2 Submerged combustion:**  
This subclass is indented under subclass 16.1. Apparatus providing a burning operation under the liquid.
- 16.3 Steam injection:**  
This subclass is indented under subclass 16.1. Apparatus wherein the blast or current is injected steam.
- 17.1 MULTIPLE EFFECTS:**  
This subclass is indented under the class definition. Apparatus relating to a series of two or more vessels in communication, adapted to cause evaporation of their liquid content at unequal pressures. The communication may be either for the purpose of transmitting the vapors evolved in one vessel to the heating element of another operating at a different pressure, or for transmitting liquid material from one vessel to another operating at a different pressure for evaporation.
- 17.2 Parallel fluid flow:**  
This subclass is indented under subclass 17.1. Apparatus wherein the fluids are in whole or in part introduced or removed from the system in parallel streams.
- 17.3 Variant multistaging:**  
This subclass is indented under subclass 17.1. Apparatus wherein the evaporation varies in kind in the different stages.
- 17.4 Contiguous evaporators:**  
This subclass is indented under subclass 17.1. Apparatus wherein evaporators share a common wall structure.
- 18 Superimposed:**  
This subclass is indented under subclass 17.1. Apparatus in which the vessels are placed one above the other, so that the vapors evolved in the lower vessel will rise by gravity into contact with the bottom of the heating element of the next vessel above.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
13.1+, for superimposed films.  
21, for combined open and closed pans.
- 19 Combined closed and open:**  
This subclass is indented under subclass 17.1. Apparatus in which the liquid undergoing treatment is evaporated in both closed and open pans at unequal pressures.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
2.1+, for evaporators employing superheating and pressure release.  
18, for superimposed multiple effect evaporators.  
21, for combined open and closed pan evaporators.
- 20.1 Variable or counterflow:**  
This subclass is indented under subclass 17.1. Apparatus in which the direction of flow from vessel to vessel of the liquid undergoing evaporation is not parallel to the flow of the evolved vapors or is variable with respect thereto, or the order of the pans in the series with respect to the flow of either vapor or liquid is variable.

- 20.2 With effect switching means:**  
This subclass is indented under subclass 20.1. Apparatus having means to shift the flow of the material treated.
- 21 COMBINED CLOSED AND OPEN PANS:**  
This subclass is indented under the class definition. Apparatus in which the liquid undergoing treatment is evaporated in both closed and open pans at substantially equal pressure.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
2.1+, for evaporators employing superheating and pressure release.  
18, for superimposed multiple effect evaporators.  
19, for combined open and closed pans in which the evaporation is at unequal pressure.
- 22 CLOSED EVAPORATING CHAMBERS:**  
This subclass is indented under the class definition. Vessels provided with covers adapted to close the surface of the evaporating liquid from the atmosphere.
- SEE OR SEARCH CLASS:  
62, Refrigeration, subclasses 100, 169+, and 268+ for processes and apparatus utilizing vacuum to cool a product.  
422, Chemical Apparatus and Process Disinfecting, Deodorizing, Preserving, or Sterilizing, subclasses 198+ and 285+ for similar devices specialized to chemistry.
- 23 Indirectly heated:**  
This subclass is indented under subclass 22. Vessel in which heat is conducted through the closed vessel to the liquid undergoing evaporation. The vessel is heated otherwise than by direct communication with a primary source of heat, such as a furnace.
- SEE OR SEARCH CLASS:  
122, Liquid Heaters and Vaporizers, subclasses 32+ for devices in which the fluid is indirectly heated by a separate fluid.  
126, Stoves and Furnaces, subclass 378.1 for an open-top liquid heating vessel that may include a lid having a closed chamber or coiled pipe to confine or direct a liquid or steam used to heat the vessel.
- 165, Heat Exchange, appropriate subclasses for a vessel having heat exchange means.
- 24.1 Regenerative:**  
This subclass is indented under subclass 23. Closed vessels in which the temperature of the vapors evolved by the evaporation is raised, and the vapors are employed to produce further evaporation.
- 24.2 Heat recovery or regeneration:**  
This subclass is indented under subclass 24.1. Apparatus having means capturing or using usually waster heat to preheat or reuse heat in the apparatus.
- 24.3 Thermocompression:**  
This subclass is indented under subclass 24.2. Apparatus wherein the spent vapor is compressed by injector means employing high pressure steam as a motive agent and introducing the combined steam as a heating agent in the evaporator.
- 25.1 Rotatable agitator or coil:**  
This subclass is indented under subclass 23. Closed vessels provided with a agitator or heating coil adapted to be rotated.
- SEE OR SEARCH CLASS:  
165, Heat Exchange, subclass 92 for a heat exchanger of general utility including an agitating or stirring coil.  
366, Agitating, subclasses 279+ for rotating agitator in a fixed receptacle.
- 25.2 Vertical axis agitator:**  
This subclass is indented under subclass 25.1. Apparatus wherein the agitator is rotated about a vertical axis.
- 26.1 Heated tube:**  
This subclass is indented under subclass 23. Closed vessels comprising a tube or tubes of heat-conducting material heated on the exterior and through which the liquid undergoing evaporation is passed.

- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
37, for steam-heated open pans.
- SEE OR SEARCH CLASS:  
122, Liquid Heaters and Vaporizers, sub-classes 235.11+ for water tube boilers.
- 26.2 Inclined:**  
This subclass is indented under subclass 26.1. Apparatus wherein the tube structure is located on an inclined plane.
- 27.1 Vertical:**  
This subclass is indented under subclass 26.1. Closed vessels in which the liquid-containing heated tube or tubes are vertically arranged.
- SEE OR SEARCH CLASS:  
122, Liquid Heaters and Vaporizers, sub-classes 332+ for water tube boilers in which the tubes are vertically arranged.
- 27.2 Detached separator:**  
This subclass is indented under subclass 27.1. Apparatus having a separator detached from the main apparatus.
- 27.3 Multieffect in one casing:**  
This subclass is indented under subclass 27.1. Apparatus wherein the fluid flows downwardly contrary to the material thermosphonic flow of the heated liquid.
- 27.4 Downflow:**  
This subclass is indented under subclass 27.1. Apparatus wherein the fluid flows downwardly contrary to the material thermosphonic flow of the heated liquid.
- 27.5 Floating calandria:**  
This subclass is indented under subclass 27.1. Apparatus wherein the heat exchanger is centrally disposed and the downcomer is the annulus between the heat exchanger and the casing.
- 28.1 Heating elements:**  
This subclass is indented under subclass 23. Devices relating to the means for maintaining the heating medium separate from, but in heating contact with, the liquid or the surface of the liquid container.
- SEE OR SEARCH CLASS:  
122, Liquid Heaters and Vaporizers, sub-classes 44.1+ for fire tube boilers.  
165, Heat Exchange, appropriate sub-classes, for the attemperator, per se.
- 28.2 Baffled:**  
This subclass is indented under subclass 28.1. Apparatus wherein the steam chest has obstructing means causing the heating medium to flow in a predetermined path among the tubes.
- 28.3 Spur tubes:**  
This subclass is indented under subclass 28.1. Apparatus wherein the heat exchange tubes are closed at one end.
- 28.4 Coils:**  
This subclass is indented under subclass 28.1. Apparatus wherein the heat exchange means is in the form of a coil.
- 28.5 Tubular inserts:**  
This subclass is indented under subclass 28.1. Apparatus wherein the heat exchange means are space fillers in tubes for confining the liquid.
- 28.6 Plate-type evaporator:**  
This subclass is indented under subclass 28.1. Apparatus wherein the heat exchange means is in the form of a plate-like evaporator.
- SEE OR SEARCH CLASS:  
122, Liquid Heaters and Vaporizers, sub-class 40 for boilers in which liquid is flashed into steam.
- 29 Directly heated:**  
This subclass is indented under subclass 22. Closed vessels combined with a heat-producing means.
- SEE OR SEARCH CLASS:  
122, Liquid Heaters and Vaporizers, appropriate subclasses for boilers.  
126, Stoves and Furnaces, subclasses 344 through 363.1 for a liquid heater that may include a kettle, a steam generator, stove pipe for use with a stove, a domestic water heater or boiler (e.g.,

- kitchen boiler, range boiler, etc.) for use with a stove or furnace.
- 422, Chemical Apparatus and Process Disinfecting, Deodorizing, Preserving, or Sterilizing, subclass 129.1 for similar apparatus used in the production of soaps.
- 30 Samplers:**  
This subclass is indented under subclass 22. Closed vessels in combination with means for withdrawing a small quantity of the liquid under evaporation for examination.
- SEE OR SEARCH CLASS:  
73, Measuring and Testing, subclasses 863.81+ for a sampler designed to remove a sample from a closed container.
- 31 Liquid traps or separators:**  
This subclass is indented under subclass 22. Closed vessels in combination with means for trapping and separating the entrained liquid from the vapors.
- SEE OR SEARCH CLASS:  
96, Gas Separation: Apparatus, appropriate subclasses for apparatus for separating liquid from a gas, per se.  
122, Liquid Heaters and Vaporizers, subclass 34 for separators in liquid heaters and vaporizers.
- 32 OPEN PANS:**  
This subclass is indented under the class definition. Vessels particularly designed for concentrating liquid material by evaporation and not provided with means to prevent access of the atmosphere to the surface of the liquid.
- SEE OR SEARCH CLASS:  
126, Stoves and Furnaces, subclasses 373.1 through 390.1 for an open-top liquid heating vessel that may include a lid.  
210, Liquid Purification or Separation, subclasses 175+ for a heater or heat exchanger in combination with a separator.
- 33 With rakes:**  
This subclass is indented under subclass 32. Open pans in combination with means to scrape from the interior surface of the pan solids deposited thereon.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
25.1+, for rotating scraper arms in closed pans.
- SEE OR SEARCH CLASS:  
34, Drying and Gas or Vapor Contact With Solids, subclasses 179+ for contact apparatus including a stationary receptacle or tube combined with an agitator or conveyor.  
209, Classifying, Separating, and Assorting Solids, subclass 453 for rotary pans and stirrers.  
422, Chemical Apparatus and Process Disinfecting, Deodorizing, Preserving, or Sterilizing, subclasses 129+ and 245.1+ for non-coating crystallizer apparatus excluded from Class 159 and not provided for elsewhere.
- 34 Tiltable, removable, or portable:**  
This subclass is indented under subclass 32. Open pans so mounted or designed that they may be tilted in or readily removed from their supports or pans especially adapted for portage.
- SEE OR SEARCH CLASS:  
126, Stoves and Furnaces, subclass 349 for a liquid heating and tilting kettle furnace.
- 35 Interposed liquid receptacle:**  
This subclass is indented under subclass 32. Open pans provided with a liquid receptacle between them and a source of heat. The liquid receptacle contains a liquid other than that undergoing concentration.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
21, for combined open and closed pans.
- SEE OR SEARCH CLASS:  
126, Stoves and Furnaces, subclass 347 for a liquid heating kettle furnace having



- a horizontal combustion chamber or subclasses 377.1-392.1 for an open-top liquid heating vessel that may include a lid having a confining, directing, or shielding feature for a liquid or steam used to heat the vessel.
- 220, Receptacles, subclasses 573.4+ for double boilers.
- 36 Steam and furnace heated:**  
This subclass is indented under subclass 32. Open pans in which both steam and furnace are employed as heating agents.
- (1) Note. Compare with this Class, subclasses 17.1 and 19, where the evaporation is effected at unequal pressure and the heating steam is evolved from the liquid undergoing evaporation.
- 37 Steam heated:**  
This subclass is indented under subclass 32. Open pans provided with heating elements adapted to be connected with a source of steam.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
26.1+, for closed evaporating chambers with heated tubes.
- 38 Furnace heated:**  
This subclass is indented under subclass 32. Open pans combined with a furnace.
- SEE OR SEARCH CLASS:  
126, Stoves and Furnaces, subclass 345 for kettle furnaces.
- 39 Liquid tubes in flue:**  
This subclass is indented under subclass 38. Open pans in which tubes are provided for communicating with the interior of the pan to circulate the liquid undergoing evaporation through the furnace or flue.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
26.1+, for closed evaporating chambers with heated tubes.
- SEE OR SEARCH CLASS:  
122, Liquid Heaters and Vaporizers, subclasses 235.11+ and 406.1+ for water-tube structure and arrangement.
- 40 Flues in pan:**  
This subclass is indented under subclass 38. Open pans in which conduits are provided communicating with the flue or combustion chamber for carrying the hot gases within the outside dimensions of the pan.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
28.1, for heating elements for closed pans.
- SEE OR SEARCH CLASS:  
122, Liquid Heaters and Vaporizers, subclasses 44.1+ for heating-tube structure and arrangement.
- 41 With dampers:**  
This subclass is indented under subclass 38. Open pans combined with furnaces and means to regulate or positively control the direction of flow of the hot gases about the pan.
- SEE OR SEARCH CLASS:  
126, Stoves and Furnaces, subclasses 285+ for dampers generally.
- 42 STRAINERS OR SKIMMERS:**  
This subclass is indented under the class definition. Subject matter combined with strainers or skimmers for removing or particularly designed to remove impurities from a liquid.
- SEE OR SEARCH CLASS:  
210, Liquid Purification or Separation, subclasses 175+ for a heater or heat exchanger in combination with a separator, especially subclasses 184+.
- 43.1 FLUID FEED OR DISCHARGE DEVICES:**  
This subclass is indented under the class definition. Subject matter including means specifically designed for feeding liquid to, or discharging concentrate from, the liquid container or for feeding a heating fluid to, or discharging it from, the container.

**43.2 With alternating operating means:**

This subclass is indented under subclass 43.1. Subject matter with means operating either or both of the feed or discharge devices successively in any arrangement.

**44 Automatic:**

This subclass is indented under subclass 43.1. Subject matter in which the feed or discharge is automatically controlled.

**SEE OR SEARCH CLASS:**

137, Fluid Handling, appropriate subclasses for fluid handling devices of general application, particularly subclasses 386+ for the control of liquid flow in response to changes in liquid level.

**45 APPARATUS FOR GRAINING AND SEPARATING CRYSTALS:**

This subclass is indented under the class definition. Apparatus specifically designed for effecting crystallization by evaporation in combination with means for collecting the crystals and discharging them from the evaporator.

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

25.1+, for rotating scraper arms.  
33, for rakes or scrapers for graining and raking crystals from the bottom of open pans.

**SEE OR SEARCH CLASS:**

117, Single-Crystal, Oriented-Crystal, and Epitaxy Growth Processes; Non-Coating Apparatus Therefor, appropriate subclasses for processes and non-coating apparatus for growing therein-defined single-crystal of all types of materials, including use of or means including a concentrating evaporator.  
422, Chemical Apparatus and Process Disinfecting, Deodorizing, Preserving, or Sterilizing, subclasses 129+ or 245.1+ for non-coating crystallizer apparatus excluded from Class 159 and not provided for elsewhere.

**46 PRELIMINARY HEATERS AND HEAT ECONOMIZERS:**

This subclass is indented under the class definition. Apparatus combined with or specifically designed for use in combination with means to effect a saving of heat.

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

17.1+, for concentrating apparatus with multiple effects.

**SEE OR SEARCH CLASS:**

122, Liquid Heaters and Vaporizers, subclasses 412+ for feed heaters for boilers generally.

**47.1 PROCESSES:**

This subclass is indented under the class definition. Subject matter relating to methods of concentration.

**SEE OR SEARCH CLASS:**

23, Chemistry: Physical Processes, subclasses 295+ for processes of concentration by evaporation combined with significant crystallization.  
127, Sugar, Starch, and Carbohydrates, subclasses 61+ for a concentration process peculiar to sugar.  
210, Liquid Purification or Separation, subclasses 774+ for a process of separating combined with heating or cooling.  
424, Drug, Bio-Affecting and Body Treating Compositions, appropriate subclasses for a process for producing a concentrate composition of that class; e.g., concentrating animal extracts such as fish liver oils to obtain a vitamin composition, etc.  
426, Food or Edible Material: Processes, Compositions, and Products, appropriate subclasses for a food working operation combined with the step concentrating.

**47.2 Involving urea:**

This subclass is indented under subclass 47.1. Processes wherein an urea containing material is concentrated.

- 47.3 Involving waste liquid:**  
This subclass is indented under subclass 47.1. Processes wherein a liquid by product is concentrated.
- 48.1 Spraying:**  
This subclass is indented under subclass 47.1. Process in which the liquid to be concentrated is reduced to the form of a spray during concentration.
- SEE OR SEARCH CLASS:  
203, Distillation: Processes, Separatory, subclass 90 for a separatory distillation process in which the distillant is introduced into the vaporization zone in the form of a spray.
- 48.2 Producing liquid product:**  
This subclass is indented under subclass 48.1. Process for making a product which is liquid in its final form.
- 49 Film:**  
This subclass is indented under subclass 47.1. Processes in which the liquid to be concentrated is spread in the form of a film or thin layer for evaporation.
- SEE OR SEARCH CLASS:  
203, Distillation: Processes, Separatory, subclasses 72 and 89 for a separatory distillation process in which the distil-land is spread on a surface in a thin film.
- 903 Solar:**  
Art collection under 902 wherein the sun furnishes heat.
- 904 Floating solar still:**  
Art collection under 903 in the form of solar still means.
- 905 SEWAGE TREATMENT:**  
This subclass is indented under the class definition. Art collection involving concentrating sewage.
- 906 WICK:**  
This subclass is indented under the class definition. Art collection involving use of a wick.

END

#### CROSS-REFERENCE ART COLLECTIONS

- 900 USING VIBRATORY FORCE:**  
This subclass is indented under the class definition. Art collection for encouraging positive circulatory motion.
- 901 PROMOTING CIRCULATION:**  
This subclass is indented under the class definition. Art collection for encouraging positive circulatory motion.
- 902 USING NATURAL HEAT:**  
This subclass is indented under the class definition. Art collection for using natural heat in any of its forms.