CPC COOPERATIVE PATENT CLASSIFICATION

F MECHANICAL ENGINEERING; LIGHTING; HEATING; WEAPONS; BLASTING
(NOTE omitted)

ENGINES OR PUMPS

F01 MACHINES OR ENGINES IN GENERAL; ENGINE PLANTS IN GENERAL; STEAM ENGINES

F01P COOLING OF MACHINES OR ENGINES IN GENERAL; COOLING OF INTERNAL-COMBUSTION ENGINES (arrangements in connection with cooling of propulsion units in vehicles B60K 11/00; heat-transfer, heat-exchange or heat-storage materials C09K 5/00; {cooling of gas-turbine engines F02C 7/12}; heat exchange in general, radiators F28)

NOTES

1. In this subclass, the following terms or expressions are used with the meanings indicated:
   - "air" also includes other gaseous cooling fluids;
   - "liquid cooling" also includes cooling where liquid is used as the heat transferring fluid between parts to be cooled and the air, e.g. using radiators;
   - "air cooling" means direct air cooling and thus excludes indirect air cooling occurring in liquid cooling systems as explained herefore;
   - "cooling-air" includes directly or indirectly acting cooling-air.
2. Attention is drawn to the notes preceding class F01, especially as regards Note (3).
3. Cooling by lubricant is classified in subclass F01M when the lubrication aspect predominates and in subclass F01P when the cooling aspect predominates.

WARNING

In this subclass non-limiting references (in the sense of paragraph 39 of the Guide to the IPC) may still be displayed in the scheme.

Air cooling; Liquid cooling (propelling cooling-air or liquid coolants F01P 5/00; controlling supply or circulation of coolants F01P 7/00; cylinders, pistons, valves, fuel injectors, sparking-plugs, or other engine or machine parts, modified to facilitate cooling, see the relevant classes for such parts)

1/00 Air cooling

2001/005 . {Cooling engine rooms}
1/02 . Arrangements for cooling cylinders or cylinder heads, e.g. ducting cooling-air from its pressure source to cylinders or along cylinders
2001/023 . . {Cooling cylinders (F01P 2003/022 takes precedence)}
2001/026 . . {Cooling cylinder heads (F01P 2003/025 takes precedence)}
1/04 . Arrangements for cooling pistons
1/06 . Arrangements for cooling other engine or machine parts
1/08 . . for cooling intake or exhaust valves
1/10 . . for cooling fuel injectors or sparking-plugs

3/00 Liquid cooling

2003/001 . {Cooling liquid}
2003/003 . . {having boiling-point higher than 100°C}
2003/005 . {the liquid being fuel}
2003/006 . {the liquid being oil}
2003/008 . {the liquid being water and oil}
3/02 . Arrangements for cooling cylinders or cylinder heads
2003/021 . . {Cooling cylinders}
2003/022 . . . {combined with air cooling}
2003/024 . . {Cooling cylinder heads}
2003/025 . . . {combined with air cooling}
2003/027 . . {Cooling cylinders and cylinder heads in parallel}
2003/028 . . {Cooling cylinders and cylinder heads in series}
3/04 . . Liquid-to-air heat-exchangers combined with, or arranged on, cylinders or cylinder heads
3/06 . Arrangements for cooling pistons
3/08 . . Cooling of piston exterior only, e.g. by jets
3/10 . . Cooling by flow of coolant through pistons
3/12 . Arrangements for cooling other engine or machine parts
3/14 . . for cooling intake or exhaust valves
3/16 . . for cooling fuel injectors or sparking-plugs
3/18 . Arrangements or mounting of liquid-to-air heat-exchangers (such arrangements on cylinders or cylinder heads F01P 3/04; relative to vehicles B60K 11/04)
2003/182 . . {with multiple heat-exchangers}
2003/185 . . {arranged in parallel}
2003/187 . . {arranged in series}
3/20 . Cooling circuits not specific to a single part of engine or machine (F01P 3/22 takes precedence)
3/202 . . {for outboard marine engines}
3/205 . . . {Flushing}
3/207 . . {liquid-to-liquid heat-exchanging relative to marine vessels}

3/22 . characterised by evaporation and condensation of coolant in closed cycles (other cooling by evaporation F01P 9/02); characterised by the coolant reaching higher temperatures than normal atmospheric boiling-point
3/2207 . . {characterised by the coolant reaching temperatures higher than the normal atmospheric boiling point}
2003/2214 . . {Condensers}
2003/2221 . . . {of the horizontal type}
2003/2228 . . . {of the upflow type}
2003/2235 . . . {of the downflow type}
2003/2242 . . . {Steam-to-steam condensers}
2003/225 . . . {Steam-to-liquid condensers}
2003/2257 . . . {Rotating condensers}
2003/2264 . . . {Separators}
3/2271 . . {Closed cycles with separator and liquid return}
2003/2278 . . {Heat pipes}
3/2285 . . {Closed cycles with condenser and feed pump}
2003/2292 . . {with thermostatically controlled by-pass}

Pumping cooling-air or liquid coolants; Controlling circulation or supply of coolants

5/00 Pumping cooling-air or liquid coolants (controlling circulation or supply of coolants by influencing drive of pumps F01P 7/00)
5/02 . Pumping cooling-air; Arrangements of cooling-air pumps, e.g. fans or blowers
2005/025 . . {using two or more air pumps}
5/04 . . Pump-driving arrangements
5/043 . . . {Pump reversing arrangements}
2005/046 . . . {with electrical pump drive}
5/06 . . Guiding or ducting air to, or from, ducted fans
5/08 . . Use of engine exhaust gases for pumping cooling-air
5/10 . Pumping liquid coolant; Arrangements of coolant pumps
2005/105 . . {Using two or more pumps}
5/12 . . Pump-driving arrangements
2005/125 . . . {Driving auxiliary pumps electrically}
5/14 . Safety means against, or active at, failure of coolant-pumps drives, e.g. shutting engine down; Means for indicating functioning of coolant pumps

7/00 Controlling of coolant flow
7/02 . the coolant being cooling-air
7/023 . . {Cowlings for airplane engines}
7/026 . . {Thermostatic control}
7/04 . . by varying pump speed, e.g. by changing pump-drive gear ratio
7/042 . . . {using fluid couplings (couplings or clutches of this type per se F16D 35/00)}
7/044 . . . {using hydraulic drives}
7/046 . . . {using mechanical drives}
7/048 . . . {using electrical drives}
7/06 . . by varying blade pitch
7/08 . . by cutting in or out of pumps
7/081 . . . {using clutches, e.g. electro-magnetic or induction clutches}
7/082 . . . . {using friction clutches}
7/084 . . . . . {actuated electromagnetically}
7/085 . . . . . {actuated by fluid pressure}
7/087 . . . . . {actuated directly by deformation of a thermostatic device}
7/088 . . . . . {actuated in response to driving speed, e.g. by centrifugal devices}
7/10 . . by throttling amount of air flowing through liquid-to-air heat exchangers
7/12 . . . by thermostatic control
7/14 . the coolant being liquid
2007/143 . . {using restrictions}
2007/146 . . {using valves}
7/16 . . by thermostatic control
7/161 . . . {by bypassing pumps}
7/162 . . . {by cutting in and out of pumps}
7/164 . . . {by varying pump speed}
7/165 . . . {characterised by systems with two or more loops}
7/167 . . . {by adjusting the pre-set temperature according to engine parameters, e.g. engine load, engine speed}
2007/168 . . . {By varying the cooling capacity of a liquid-to-air heat-exchanger}

9/00 Cooling having pertinent characteristics not provided for in, or of interest apart from, groups F01P 1/00 - F01P 7/00 (profiting from waste heat of combustion-engine cooling F02G 5/00)
2009/005 . {Cooling with melting solids}
9/02 . Cooling by evaporation, e.g. by spraying water on to cylinders (evaporation and condensation of liquid coolant in closed cycles F01P 3/22 {; evaporation or evaporation apparatus for physical or chemical purposes, e.g. evaporation of liquids for gas phase reactions B01B 1/005})
9/04 . by simultaneous or alternative use of direct air-cooling and liquid cooling (F01P 9/02 takes precedence)
9/06 . by use of refrigerating apparatus, e.g. of compressor or absorber type

11/00 Component parts, details, or accessories not provided for in, or of interest apart from, groups F01P 1/00 - F01P 9/00
11/02 . Liquid-coolant {filling}, overflow, venting, or draining devices (automatic draining during freezing conditions F01P 11/20)
11/0204 . . {Filling}
11/0209 . . . {Closure caps}
11/0214 . . . . {Mounting}
2011/0219 . . . . . {using bayonet connections}
2011/0223 . . . . . {Decoration}
2011/0228 . . . . . {Sealing}
2011/0233 . . . . . {Venting}
11/0238 . . . . {with overpressure valves or vent valves}
2011/0242 . . . . . {setting the pressure valve}
11/0247 . . . . {Safety; Locking against opening}
2011/0252 . . . . . {Venting before opening}
2011/0257 . . . . . {with theft preventing means}
2011/0261 . . . . . {activated by temperature}
2011/0266 . . . . . {activated by pressure}
2011/0271 . . . . {Semi-permeable, e.g. using Gore-Tex c fibres}
11/0276 . . {Draining or purging}
11/028 . . {Deaeration devices}
11/0285 . . {Venting devices}

11/029 . . {Expansion reservoirs}
11/0295 . . {Condensers for radiators}
11/04 . Arrangements of liquid pipes or hoses
11/06 . Cleaning (in general B08B); Combating corrosion (in general C23F)
2011/061 . . {Cleaning or combating corrosion using filters}
2011/063 . . {Cleaning (F01P 2011/061 takes precedence)}
2011/065 . . {Flushing}
2011/066 . . {Combating corrosion (F01P 2011/061 takes precedence)}
2011/068 . . . {chemically}
11/08 . Arrangements of lubricant coolers (in lubrication apparatus F01M)
11/10 . Guiding or ducting cooling-air, to, or from, liquid-to-air heat exchangers
11/12 . Filtering, cooling, or silencing cooling-air
11/14 . Indicating devices; Other safety devices
11/16 . . concerning coolant temperature (F01P 11/20 takes precedence)
11/18 . . concerning coolant pressure, coolant flow, or liquid-coolant level
11/20 . . concerning atmospheric freezing conditions, e.g. automatically draining or heating during frosty weather
2011/205 . . {using heat-accumulators}

2023/00 Signal processing; Details thereof
2023/08 . Microprocessor; Microcomputer

Air cooling; Liquid cooling (propelling cooling-air or liquid coolants F01P 5/00; controlling supply or circulation of coolants F01P 7/00; cylinders, pistons, valves, fuel injectors, sparking-plugs, or other engine or machine parts, modified to facilitate cooling, see the relevant classes for such parts)

2025/00 Measuring
2025/04 . Pressure
2025/06 . . for determining flow
2025/08 . Temperature
2025/12 . . Cabin temperature
2025/13 . . Ambient temperature
2025/30 . . Engine incoming fluid temperature
2025/31 . . Cylinder temperature
2025/32 . . Engine outcoming fluid temperature
2025/33 . . Cylinder head temperature
2025/34 . . Heat exchanger incoming fluid temperature
2025/36 . . Heat exchanger mixed fluid temperature
2025/40 . . Oil temperature
2025/42 . . Intake manifold temperature
2025/44 . . Outlet manifold temperature
2025/46 . . Engine parts temperature
2025/48 . . Engine room temperature
2025/50 . . using two or more temperature sensors
2025/52 . . Heat exchanger temperature
2025/60 . Operating parameters
2025/62 . . Load
2025/64 . . Number of revolutions
2025/66 . . Vehicle speed
2025/70 . Level
2025/80 . Concentration anti-freeze

2031/00 Fail safe
2031/16 . using melting materials
2031/18 . Detecting fluid leaks
2031/20 . Warning devices
2031/22 . using warning lamps
2031/24 . for freezing
2031/30 . Cooling after the engine is stopped
2031/32 . Deblocking of damaged thermostat
2031/34 . Limping home
2031/36 . Failure of coolant pump

2037/00 Controlling
2037/02 . starting

2050/00 Applications
2050/02 . Marine engines
2050/04 . . using direct cooling
2050/06 . . using liquid-to-liquid heat exchangers
2050/08 . . Engine room
2050/10 . . Z-type engine
2050/12 . . Outboard engine
2050/16 . Motor-cycles
2050/20 . Aircraft engines
2050/22 . Motor-cars
2050/24 . Hybrid vehicles
2050/30 . Circuit boards

2060/00 Cooling circuits using auxiliaries
2060/02 . Intercooler
2060/04 . Lubricant cooler
2060/045 . . for transmissions
2060/06 . Retarder
2060/08 . Cabin heater
2060/10 . Fuel manifold
2060/12 . Turbo charger
2060/14 . Condenser
2060/16 . Outlet manifold
2060/18 . Heater
2060/185 . . for alternators or generators

2070/00 Details
2070/02 . using shape memory alloys
2070/04 . using electrical heating elements
2070/06 . Using intake pressure as actuating fluid
2070/08 . Using lubricant pressure as actuating fluid
2070/10 . using electrical or electromechanical means
2070/30 . Rotating radiators
2070/32 . Ring-shaped heat exchangers
2070/50 . mounting fans to heat-exchangers
2070/52 . mounting heat-exchangers