CPC COOPERATIVE PATENT CLASSIFICATION

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)

NOTE

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.

Attention is drawn to the notes preceding class F01, especially as regards Note (3).

Cooling by lubricant is classified in subclass F01M when the lubrication aspect predominates and in subclass F01P when the cooling aspect predominates.

Guidance heading: **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)

F01P 1/00 **Air cooling**

F01P 1/02 . Arrangements for cooling cylinders or cylinder heads, e.g. ducting cooling-air from its pressure source to cylinders or along cylinders

F01P 1/04 . Arrangements for cooling pistons

F01P 1/06 . Arrangements for cooling other engine or machine parts

F01P 1/08 . . for cooling intake or exhaust valves

F01P 1/10 . . for cooling fuel injectors or sparking-plugs

F01P 3/00 **Liquid cooling**

F01P 3/02 . Arrangements for cooling cylinders or cylinder heads

F01P 3/04 . . Liquid-to-air heat-exchangers combined with, or arranged on, cylinders or cylinder heads

F01P 3/06 . Arrangements for cooling pistons

F01P 3/08 . . Cooling of piston exterior only, e.g. by jets

F01P 3/10 . . Cooling by flow of coolant through pistons

F01P 3/12 . Arrangements for cooling other engine or machine parts

F01P 3/14 . . for cooling intake or exhaust valves

F01P 3/16 . . for cooling fuel injectors or sparking-plugs

F01P 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)

F01P 3/20 . Cooling circuits not specific to a single part of engine or machine (F01P 3/22 takes precedence)

F01P 3/202 . . { for outboard marine engines }

F01P 3/205 . . . { Flushing }

F01P 3/207 . . { liquid-to-liquid heat-exchanging relative to marine vessels }

F01P 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

F01P 3/2207 . . { characterised by the coolant reaching temperatures higher than the normal atmospheric boiling point }

F01P 3/2271 . . { Closed cycles with separator and liquid return }

F01P 3/2285 . . { Closed cycles with condenser and feed pump }

Guidance heading: **Pumping cooling-air or liquid coolants; Controlling circulation or supply of coolants**

F01P 5/00 **Pumping cooling-air or liquid coolants** (controlling circulation or supply of coolants by influencing drive of pumps F01P 7/00)

F01P 5/02 . Pumping cooling-air; Arrangements of cooling-air pumps, e.g. fans or blowers

F01P 5/04 . . Pump-driving arrangements

F01P 5/043 . . . { Pump reversing arrangements }

F01P 5/06 . . Guiding or ducting air to, or from, ducted fans

F01P 5/08 . . Use of engine exhaust gases for pumping cooling-air

F01P 5/10 . Pumping liquid coolant; Arrangements of coolant pumps

F01P 5/12 . . Pump-driving arrangements

F01P 5/14 . Safety means against, or active at, failure of coolant-pump drives, e.g. shutting engine down; Means for indicating functioning of coolant pump

F01P 7/00 **Controlling of coolant flow**

F01P 7/02 . the coolant being cooling-air

F01P 7/023 . . { Cowlings for airplane engines }

F01P 7/026 . . { Thermostatic control }

F01P 7/04 . . by varying pump speed, e.g. by changing pump-drive gear ratio
F01P 7/042 . . . { using fluid couplings (couplings or clutches of this type per se F16D 35/00)}
F01P 7/044 . . . { using hydraulic drives }
F01P 7/046 . . . { using mechanical drives }
F01P 7/048 . . . { using electrical drives }
F01P 7/06 . . by varying blade pitch
F01P 7/08 . . by cutting in or out of pumps
F01P 7/081 . . . { using clutches, e.g. electro-magnetic or induction clutches }
F01P 7/082 . . . . { using friction clutches }
F01P 7/084 . . . . . { actuated electromagnetically }
F01P 7/085 . . . . . { actuated by fluid pressure }
F01P 7/087 . . . . . { actuated directly by deformation of a thermostatic device }
F01P 7/088 . . . . . { actuated in response to driving speed, e.g. by centrifugal devices }
F01P 7/10 . . by throttling amount of air flowing through liquid-to-air heat exchangers
F01P 7/12 . . . by thermostatic control

F01P 7/14 . the coolant being liquid
F01P 7/16 . . by thermostatic control
F01P 7/161 . . . { by bypassing pumps }
F01P 7/162 . . . { by cutting in and out of pumps }
F01P 7/164 . . . { by varying pump speed }
F01P 7/165 . . . { characterised by systems with two or more loops }
F01P 7/167 . . . { by adjusting the pre-set temperature according to engine parameters, e.g. engine load, engine speed }

F01P 9/00 **Cooling having pertinent characteristics not provided for in, or of interest apart from, groups F01P 1/00 to F01P 7/00** (profiting from waste heat of combustion-engine cooling F02G 5/00)

F01P 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 })

F01P 9/04 . by simultaneous or alternative use of direct air-cooling and liquid cooling (F01P 9/02 takes precedence)

F01P 9/06 . by use of refrigerating apparatus, e.g. of compressor or absorber type

F01P 11/00 **Component parts, details, or accessories not provided for in, or of interest apart from, groups F01P 1/00 to F01P 9/00**

F01P 11/02 . Liquid-coolant { filling }, overflow, venting, or draining devices (automatic draining during freezing conditions F01P 11/20)
F01P 11/0204 . . { Filling }
F01P 11/0209 . . . { Closure caps }

F01P 11/0214 . . . . { Mounting }
F01P 11/0238 . . . . { with overpressure valves or vent valves }
F01P 11/0247 . . . . { Safety; Locking against opening }
F01P 11/0276 . . { Draining or purging }
F01P 11/028 . . { Deaeration devices }
F01P 11/0285 . . { Venting devices }
F01P 11/029 . . { Expansion reservoirs }
F01P 11/0295 . . { Condensers for radiators }

F01P 11/04 . Arrangements of liquid pipes or hoses

F01P 11/06 . Cleaning (in general B08B); Combating corrosion (in general C23F)

F01P 11/08 . Arrangements of lubricant coolers (in lubrication apparatus F01M)

F01P 11/10 . Guiding or ducting cooling-air, to, or from, liquid-to-air heat exchangers

F01P 11/12 . Filtering, cooling, or silencing cooling-air

F01P 11/14 . Indicating devices; Other safety devices
F01P 11/16 . . concerning coolant temperature (F01P 11/20 takes precedence)
F01P 11/18 . . concerning coolant pressure, coolant flow, or liquid-coolant level
F01P 11/20 . . concerning atmospheric freezing conditions, e.g. automatically draining or heating during frosty weather

F01P 2001/00 Air cooling

F01P 2001/005 . Cooling engine rooms

F01P 2001/02 . Arrangements for cooling cylinders or cylinder heads, e.g. ducting cooling-air from its pressure source to cylinders or along cylinders
F01P 2001/023 . . Cooling cylinders (F01P 2003/022 takes precedence)
F01P 2001/026 . . Cooling cylinder heads (F01P 2003/025 takes precedence)

F01P 2003/00 Liquid cooling

F01P 2003/001 . Cooling liquid
F01P 2003/003 . . having boiling-point higher than 100°C

F01P 2003/005 . the liquid being fuel

F01P 2003/006 . the liquid being oil

F01P 2003/008 . the liquid being water and oil

F01P 2003/02 . Arrangements for cooling cylinders or cylinder heads
F01P 2003/021 . . Cooling cylinders

F01P 2003/022 . . . combined with air cooling
F01P 2003/024 . . Cooling cylinder heads
F01P 2003/025 . . . combined with air cooling
F01P 2003/027 . . Cooling cylinders and cylinder heads in parallel
F01P 2003/028 . . Cooling cylinders and cylinder heads in series

F01P 2003/18 . 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)
F01P 2003/182 . . with multiple heat-exchangers
F01P 2003/185 . . arranged in parallel
F01P 2003/187 . . arranged in series

F01P 2003/22 . 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
F01P 2003/2214 . . Condensers
F01P 2003/2221 . . . of the horizontal type
F01P 2003/2228 . . . of the upflow type
F01P 2003/2235 . . . of the downflow type
F01P 2003/2242 . . . Steam-to-steam condensers
F01P 2003/225 . . . Steam-to-liquid condensers
F01P 2003/2257 . . . Rotating condensers
F01P 2003/2264 . . . Separators
F01P 2003/2278 . . Heat pipes
F01P 2003/2292 . . with thermostatically controlled by-pass

F01P 2005/00 **Pumping cooling-air or liquid coolants** (controlling circulation or supply of coolants by influencing drive of pumps F01P 7/00)

F01P 2005/02 . Pumping cooling-air; Arrangements of cooling-air pumps, e.g. fans or blowers
F01P 2005/025 . . using two or more air pumps
F01P 2005/04 . . Pump-driving arrangements
F01P 2005/046 . . . with electrical pump drive

F01P 2005/10 . Pumping liquid coolant; Arrangements of coolant pumps
F01P 2005/105 . . Using two or more pumps
F01P 2005/12 . . Pump-driving arrangements
F01P 2005/125 . . . Driving auxiliary pumps electrically

F01P 2007/00 **Controlling of coolant flow**

F01P 2007/14 . the coolant being liquid
F01P 2007/143 . . using restrictions
F01P 2007/146 . . using valves
F01P 2007/16 . . by thermostatic control

F01P 2007/168 . . . By varying the cooling capacity of a liquid-to-air heat-exchanger

F01P 2009/00 **Cooling having pertinent characteristics not provided for in, or of interest apart from, groups F01P 1/00 to F01P 7/00** (profiting from waste heat of combustion-engine cooling F02G 5/00)

F01P 2009/005 . Cooling with melting solids

F01P 2011/00 **Component parts, details, or accessories not provided for in, or of interest apart from, groups F01P 1/00 to F01P 9/00**

F01P 2011/02 . Liquid-coolant { filling }, overflow, venting, or draining devices (automatic draining during freezing conditions F01P 11/20)
F01P 2011/0204 . . { Filling }
F01P 2011/0209 . . . { Closure caps }
F01P 2011/0214 . . . . { Mounting }
F01P 2011/0219 . . . . . using bayonet connections
F01P 2011/0223 . . . . . Decoration
F01P 2011/0228 . . . . . Sealing
F01P 2011/0233 . . . . . Venting
F01P 2011/0238 . . . . { with overpressure valves or vent valves }
F01P 2011/0242 . . . . . setting the pressure valve
F01P 2011/0247 . . . . { Safety; Locking against opening }
F01P 2011/0252 . . . . . Venting before opening
F01P 2011/0257 . . . . . with theft preventing means
F01P 2011/0261 . . . . . activated by temperature
F01P 2011/0266 . . . . . activated by pressure
F01P 2011/0271 . . . . Semi-permeable, e.g. using Gore-Tex c fibres

F01P 2011/06 . Cleaning (in general B08B); Combating corrosion (in general C23F)
F01P 2011/061 . . Cleaning or combatting corrosion using filters
F01P 2011/063 . . Cleaning (F01P 2011/061 takes precedence)
F01P 2011/065 . . Flushing
F01P 2011/066 . . Combatting corrosion (F01P 2011/061 takes precedence)
F01P 2011/068 . . . chemically

F01P 2011/14 . Indicating devices; Other safety devices
F01P 2011/205 . . using heat-accumulators

F01P 2023/00 **Signal processing; Details thereof**

F01P 2023/08 . Microprocessor; Microcomputer

Guidance heading: **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)

F01P 2025/00 **Measuring**

F01P 2025/04 . Pressure
F01P 2025/06 . . for determining flow

F01P 2025/08 . Temperature
F01P 2025/12 . . Cabin temperature
F01P 2025/13 . . Ambient temperature
F01P 2025/30 . . Engine incoming fluid temperature
F01P 2025/31 . . Cylinder temperature
F01P 2025/32 . . Engine outcoming fluid temperature
F01P 2025/33 . . Cylinder head temperature
F01P 2025/34 . . Heat exchanger incoming fluid temperature
F01P 2025/36 . . Heat exchanger mixed fluid temperature
F01P 2025/40 . . Oil temperature
F01P 2025/42 . . Intake manifold temperature
F01P 2025/44 . . Outlet manifold temperature
F01P 2025/46 . . Engine parts temperature
F01P 2025/48 . . Engine room temperature
F01P 2025/50 . . using two or more temperature sensors
F01P 2025/52 . . Heat exchanger temperature

F01P 2025/60 . Operating parameters
F01P 2025/62 . . Load
F01P 2025/64 . . Number of revolutions
F01P 2025/66 . . Vehicle speed

F01P 2025/70 . Level

F01P 2025/80 . Concentration anti-freeze

F01P 2031/00 **Fail safe**

F01P 2031/16 . using melting materials

F01P 2031/18 . Detecting fluid leaks

F01P 2031/20 . Warning devices

F01P 2031/22 . using warning lamps

F01P 2031/24 . for freezing

F01P 2031/30 . Cooling after the engine is stopped

F01P 2031/32 . Deblocking of damaged thermostat

F01P 2031/34 . Limping home

F01P 2031/36 . Failure of coolant pump

F01P 2037/00 Controlling

F01P 2037/02 . starting

F01P 2050/00 Applications

F01P 2050/02 . Marine engines
F01P 2050/04 . . using direct cooling
F01P 2050/06 . . using liquid-to-liquid heat exchangers
F01P 2050/08 . . Engine room
F01P 2050/10 . . Z-type engine
F01P 2050/12 . . Outboard engine

F01P 2050/16 . Motor-cycles

F01P 2050/20 . Aircraft engines

F01P 2050/22 . Motor-cars

F01P 2050/24 . Hybrid vehicles

F01P 2050/30 . Circuit boards

F01P 2060/00 Cooling circuits using auxiliaries

F01P 2060/02 . Intercooler

F01P 2060/04 . Lubricant cooler
F01P 2060/045 . . for transmissions

F01P 2060/06 . Retarder

F01P 2060/08 . Cabin heater

F01P 2060/10 . Fuel manifold

F01P 2060/12 . Turbo charger

F01P 2060/14 . Condenser

F01P 2060/16 . Outlet manifold

F01P 2060/18 . Heater
F01P 2060/185 . . for alternators or generators

F01P 2070/00 Details

F01P 2070/02 . using shape memory alloys

F01P 2070/04 . using electrical heating elements

F01P 2070/06 . Using intake pressure as actuating fluid

F01P 2070/08 . Using lubricant pressure as actuating fluid

F01P 2070/10 . using electrical or electromechanical means

F01P 2070/30 . Rotating radiators

F01P 2070/32 . Ring-shaped heat exchangers

F01P 2070/50 . mounting fans to heat-exchangers

F01P 2070/52 . mounting heat-exchangers