

# CPC COOPERATIVE PATENT CLASSIFICATION

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

### LIGHTING; HEATING

#### F28 HEAT EXCHANGE IN GENERAL (NOTES omitted)

#### F28F DETAILS OF HEAT-EXCHANGE AND HEAT-TRANSFER APPARATUS, OF GENERAL APPLICATION (water and air traps, air venting [F16](#))

##### 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.

1/00	<b>Tubular elements; Assemblies of tubular elements</b> (specially adapted for movement <a href="#">F28F 5/00</a> )	1/20	. . . . the means being attachable to the element ( <a href="#">F28F 1/22</a> takes precedence)
1/003	. {Multiple wall conduits, e.g. for leak detection (leak-detection in metal cooled nuclear reactor steam generators <a href="#">F22B 1/066</a> )}	1/22	. . . . the means having portions engaging further tubular elements
1/006	. {with variable shape, e.g. with modified tube ends, with different geometrical features ( <a href="#">F28F 1/025</a> , <a href="#">F28F 1/06</a> , <a href="#">F28F 1/08</a> , <a href="#">F28F 9/16</a> , <a href="#">F28F 9/18</a> take precedence)}	1/24	. . . and extending transversely ( <a href="#">F28F 1/38</a> takes precedence)
1/02	. Tubular elements of cross-section which is non- circular ( <a href="#">F28F 1/08</a> , <a href="#">F28F 1/10</a> take precedence)	1/26	. . . . the means being integral with the element ( <a href="#">F28F 1/32</a> takes precedence)
1/022	. . {with multiple channels}	1/28	. . . . . the element being built-up from finned sections
1/025	. . {with variable shape, e.g. with modified tube ends, with different geometrical features ( <a href="#">F28F 1/06</a> , <a href="#">F28F 1/08</a> , <a href="#">F28F 9/16</a> , <a href="#">F28F 9/18</a> take precedence)}	1/30	. . . . the means being attachable to the element ( <a href="#">F28F 1/32</a> takes precedence)
2001/027	. . {with dimples}	1/32	. . . . the means having portions engaging further tubular elements
1/04	. . polygonal, e.g. rectangular {( <a href="#">F28F 1/022</a> takes precedence)}	1/325	. . . . . {Fins with openings}
1/045	. . . {with assemblies of stacked elements}	1/34	. . . and extending obliquely ( <a href="#">F28F 1/38</a> takes precedence)
1/06	. . crimped or corrugated in cross-section	1/36	. . . . the means being helically wound fins or wire spirals
1/08	. Tubular elements crimped or corrugated in longitudinal section	1/38	. . . and being staggered to form tortuous fluid passages
1/10	. Tubular elements and assemblies thereof with means for increasing heat-transfer area, e.g. with fins, with projections, with recesses (crimped or corrugated elements <a href="#">F28F 1/06</a> , <a href="#">F28F 1/08</a> )	1/40	. . the means being only inside the tubular element
1/105	. . {the means being corrugated elements extending around the tubular elements}	1/405	. . . {and being formed of wires}
1/12	. . the means being only outside the tubular element	1/42	. . the means being both outside and inside the tubular element
1/122	. . . {and being formed of wires}	1/422	. . . {with outside means integral with the tubular element and inside means integral with the tubular element ( <a href="#">F28F 1/424</a> takes precedence)}
1/124	. . . {and being formed of pins}	1/424	. . . {Means comprising outside portions integral with inside portions}
1/126	. . . {consisting of zig-zag shaped fins ( <a href="#">F28F 1/105</a> takes precedence)}	1/426	. . . . {the outside portions and the inside portions forming parts of complementary shape, e.g. concave and convex}
1/128	. . . . {Fins with openings, e.g. louvered fins}	2001/428	. . . {Particular methods for manufacturing outside or inside fins}
1/14	. . . and extending longitudinally ( <a href="#">F28F 1/38</a> takes precedence)	1/44	. . . and being formed of wire mesh
1/16	. . . . the means being integral with the element, e.g. formed by extrusion ( <a href="#">F28F 1/22</a> takes precedence)	3/00	<b>Plate-like or laminated elements; Assemblies of plate-like or laminated elements (specially adapted for movement <a href="#">F28F 5/00</a>)</b>
1/18	. . . . . the element being built-up from finned sections	3/005	. {Arrangements for preventing direct contact between different heat-exchange media ( <a href="#">F28F 3/10</a> takes precedence)}

- 3/02 . Elements or assemblies thereof with means for increasing heat-transfer area, e.g. with fins, with recesses, with corrugations ([F28F 3/08](#) takes precedence)
- 3/022 . . {the means being wires or pins}
- 3/025 . . {the means being corrugated, plate-like elements}
- 3/027 . . . {with openings, e.g. louvered corrugated fins; Assemblies of corrugated strips}
- 3/04 . . the means being integral with the element
- 3/042 . . . {in the form of local deformations of the element}
- 3/044 . . . . {the deformations being pontual, e.g. dimples}
- 3/046 . . . . {the deformations being linear, e.g. corrugations}
- 3/048 . . . {in the form of ribs integral with the element or local variations in thickness of the element, e.g. grooves, microchannels}
- 3/06 . . the means being attachable to the element
- 3/08 . Elements constructed for building-up into stacks, e.g. capable of being taken apart for cleaning
- 3/083 . . {capable of being taken apart}
- 3/086 . . {having one or more openings therein forming tubular heat-exchange passages}
- 3/10 . . Arrangements for sealing the margins
- 3/12 . Elements constructed in the shape of a hollow panel, e.g. with channels ([F28D 1/02](#), [F28D 1/03](#) take precedence)
- 3/14 . . by separating portions of a pair of joined sheets to form channels, e.g. by inflation ([manufacture thereof B23P](#))
- 5/00 Elements specially adapted for movement**  
(arrangements for moving the elements, see the appropriate subclass for the apparatus concerned)
- 5/02 . Rotary drums or rollers
- 5/04 . Hollow impellers, e.g. stirring vane
- 5/06 . Hollow screw conveyors
- 7/00 Elements not covered by group [F28F 1/00](#), [F28F 3/00](#) or [F28F 5/00](#)**
- 7/02 . Blocks traversed by passages for heat-exchange media ([F28D 7/0008](#) takes precedence)
- 9/00 Casings; Header boxes; Auxiliary supports for elements; Auxiliary members within casings**
- 9/001 . {Casings in the form of plate-like arrangements; Frames enclosing a heat exchange core}
- 9/002 . . {with fastening means for other structures}
- 2009/004 . . {Common frame elements for multiple cores}
- 9/005 . {Other auxiliary members within casings, e.g. internal filling means or sealing means}
- 9/007 . Auxiliary supports for elements
- 9/0075 . . {Supports for plates or plate assemblies}
- 9/013 . . for tubes or tube-assemblies
- 9/0131 . . . {formed by plates ([F28F 9/0138](#) takes precedence)}
- 9/0132 . . . {formed by slats, tie-rods, articulated or expandable rods}
- 9/0133 . . . {formed by concentric strips}
- 9/0135 . . . {formed by grids having only one tube per closed grid opening ([F28F 9/0132](#) and [F28F 9/0133](#) take precedence)}
- 9/0136 . . . . {formed by intersecting strips}
- 9/0137 . . . {formed by wires, e.g. helically coiled ([F28F 9/0135](#) takes precedence)}
- 9/0138 . . . {formed by sleeves for finned tubes}
- 9/02 . Header boxes; End plates
- 9/0202 . . {Header boxes having their inner space divided by partitions}
- 9/0204 . . . {for elongated header box, e.g. with transversal and longitudinal partitions}
- 9/0207 . . . . {the longitudinal or transversal partitions being separate elements attached to header boxes ([F28F 9/0212](#), [F28F 9/0217](#) take precedence)}
- 9/0209 . . . . {having only transversal partitions}
- 9/0212 . . . . {the partitions being separate elements attached to header boxes}
- 9/0214 . . . . {having only longitudinal partitions}
- 9/0217 . . . . {the partitions being separate elements attached to header boxes}
- 9/0219 . . {Arrangements for sealing end plates into casing or header box; Header box sub-elements ([F28F 9/0236](#) takes precedence)}
- 9/0221 . . . {Header boxes or end plates formed by stacked elements}
- 9/0224 . . . {Header boxes formed by sealing end plates into covers ([F28F 9/0221](#) takes precedence)}
- 9/0226 . . . . {with resilient gaskets}
- 9/0229 . . {Double end plates; Single end plates with hollow spaces}
- 9/0231 . . {Header boxes having an expansion chamber}
- 9/0234 . . {having a second heat exchanger disposed there within, e.g. oil cooler}
- 9/0236 . . {floating elements}
- 9/0239 . . . {floating header boxes}
- 9/0241 . . . {floating end plates}
- 9/0243 . . {Header boxes having a circular cross-section}
- 9/0246 . . {Arrangements for connecting header boxes with flow lines}
- 9/0248 . . . {Arrangements for sealing connectors to header boxes}
- 9/0251 . . . {Massive connectors, e.g. blocks; Plate-like connectors}
- 9/0253 . . . . {with multiple channels, e.g. with combined inflow and outflow channels}
- 9/0256 . . . {Arrangements for coupling connectors with flow lines}
- 9/0258 . . . . {of quick acting type, e.g. with snap action}
- 9/026 . . {with static flow control means, e.g. with means for uniformly distributing heat exchange media into conduits}
- 9/0263 . . . {by varying the geometry or cross-section of header box}
- 9/0265 . . . {by using guiding means or impingement means inside the header box}
- 9/0268 . . . . {in the form of multiple deflectors for channeling the heat exchange medium}
- 9/027 . . . {in the form of distribution pipes}
- 9/0273 . . . . {with multiple holes}
- 9/0275 . . . . {with multiple branch pipes}
- 9/0278 . . . {in the form of stacked distribution plates or perforated plates arranged over end plates}
- 9/028 . . . {by using inserts for modifying the pattern of flow inside the header box, e.g. by using flow restrictors or permeable bodies or blocks with channels}

9/0282	. . . {by varying the geometry of conduit ends, e.g. by using inserts or attachments for modifying the pattern of flow at the conduit inlet or outlet}	9/266	. . . {by screw-type connections}
2009/0285	. . . {Other particular headers or end plates}	9/268	. . . {by permanent joints, e.g. by welding}
2009/0287	. . . {having passages for different heat exchange media}	<b>11/00</b>	<b>Arrangements for sealing leaky tubes and conduits (stopping flow from or in pipes in general <a href="#">F16L 55/10</a>)</b>
2009/029	. . . {with increasing or decreasing cross-section, e.g. having conical shape}	11/02	. using obturating elements, e.g. washers, inserted and operated independently of each other ( <a href="#">F28F 11/06</a> takes precedence)
2009/0292	. . . {with fins}	11/04	. using pairs of obturating elements, e.g. washers, mounted upon central operating rods ( <a href="#">F28F 11/06</a> takes precedence)
2009/0295	. . . {comprising cooling circuits}	11/06	. using automatic tube obturating appliances
2009/0297	. . . {Side headers, e.g. for radiators having conduits laterally connected to common header}	<b>13/00</b>	<b>Arrangements for modifying heat-transfer, e.g. increasing, decreasing (<a href="#">F28F 1/00</a> - <a href="#">F28F 11/00</a> take precedence)</b>
9/04	. . Arrangements for sealing elements into header boxes or end plates ( <a href="#">arrangements for sealing flow lines connectors to header boxes <a href="#">F28F 9/0248</a></a> )	2013/001	. {Particular heat conductive materials, e.g. superconductive elements (for thermal joints <a href="#">F28F 2013/006</a> )}
9/06	. . . by dismantable joints	13/003	. {by using permeable mass, perforated or porous materials ( <a href="#">F28F 13/18</a> takes precedence)}
9/08	. . . . by wedge-type connections, e.g. taper ferrule	2013/005	. {Thermal joints}
9/10	. . . . by screw-type connections, e.g. gland	2013/006	. . {Heat conductive materials}
9/12	. . . . by flange-type connections	2013/008	. . {Variable conductance materials; Thermal switches}
9/14	. . . . by force-joining	13/02	. by influencing fluid boundary (boundary-layer control in general <a href="#">F15D</a> )
9/16	. . . by permanent joints, e.g. by rolling ( <a href="#">metal-working procedures in general <a href="#">B21</a>, <a href="#">B32</a>; particularly <a href="#">B21D 39/06</a>, <a href="#">B23K</a></a> )	13/04	. by preventing the formation of continuous films of condensate on heat-exchange surfaces, e.g. by promoting droplet formation ( <a href="#">F28F 13/18</a> takes precedence)
9/162	. . . . {by using bonding or sealing substances, e.g. adhesives ( <a href="#">F28F 9/18</a> takes precedence)}	13/06	. by affecting the pattern of flow of the heat-exchange media ( <a href="#">F28F 13/003</a> takes precedence; static flow control means in header boxes <a href="#">F28F 9/026</a> )
9/165	. . . . {by using additional preformed parts, e.g. sleeves, gaskets ( <a href="#">F28F 9/185</a> takes precedence)}	13/08	. . by varying the cross-section of the flow channels
9/167	. . . . . {the parts being inserted in the heat-exchange conduits}	13/10	. . by imparting a pulsating motion to the flow, e.g. by sonic vibration
9/18	. . . . by welding	13/12	. . by creating turbulence, e.g. by stirring, by increasing the force of circulation ( <a href="#">F28F 13/08</a> takes precedence)
9/182	. . . . . {the heat-exchange conduits having ends with a particular shape, e.g. deformed; the heat-exchange conduits or end plates having supplementary joining means, e.g. abutments}	13/125	. . . {by stirring}
9/185	. . . . . {with additional preformed parts}	13/14	. by endowing the walls of conduits with zones of different degrees of conduction of heat
9/187	. . . . . {at least one of the parts being non-metallic, e.g. heat-sealing plastic elements}	13/16	. by applying an electrostatic field to the body of the heat-exchange medium
9/20	. Arrangements of heat reflectors, e.g. separately-insertible reflecting walls	13/18	. by applying coatings, e.g. radiation-absorbing, radiation-reflecting; by surface treatment, e.g. polishing
9/22	. Arrangements for directing heat-exchange media into successive compartments, e.g. arrangements of guide plates	13/182	. . {especially adapted for evaporator or condenser surfaces ( <a href="#">F28F 13/187</a> takes precedence)}
2009/222	. . {Particular guide plates, baffles or deflectors, e.g. having particular orientation relative to an elongated casing or conduit}	13/185	. . {Heat-exchange surfaces provided with microstructures or with porous coatings}
2009/224	. . . {Longitudinal partitions}	13/187	. . . {especially adapted for evaporator surfaces or condenser surfaces, e.g. with nucleation sites}
2009/226	. . . {Transversal partitions}	<b>17/00</b>	<b>Removing ice or water from heat-exchange apparatus</b>
2009/228	. . . {Oblique partitions}	17/005	. {Means for draining condensates from heat exchangers, e.g. from evaporators ( <a href="#">F28B 9/08</a> takes precedence)}
9/24	. Arrangements for promoting turbulent flow of heat-exchange media, e.g. by plates ( <a href="#">F28F 1/38</a> takes precedence; in general <a href="#">F15D</a> )	<b>19/00</b>	<b>Preventing the formation of deposits or corrosion, e.g. by using filters {or scrapers}</b>
9/26	. Arrangements for connecting different sections of heat-exchange elements, e.g. of radiators (connecting different sections in water heaters <a href="#">F24H 9/14</a> {, connecting headers with inlet or outlet fittings <a href="#">F28F 9/0246</a> })	19/002	. {by using inserts or attachments}
9/262	. . {for radiators ( <a href="#">F28D 1/0408</a> takes precedence)}		
9/264	. . . {by sleeves, nipples}		

19/004	. {by using protective electric currents, voltages, cathodes, anodes, electric short-circuits}	25/082	. . . {Spaced elongated bars, laths; Supports therefor}
19/006	. {Preventing deposits of ice}	25/085	. . . {Substantially horizontal grids; Blocks}
19/008	. {by using scrapers}	25/087	. . . {Vertical or inclined sheets; Supports or spacers}
19/01	. by using means for separating solid materials from heat-exchange fluids, e.g. filters	25/10	. for feeding gas or vapour
19/02	. by using coatings, e.g. vitreous or enamel coatings	25/12	. . Ducts; Guide vanes, e.g. for carrying currents to distinct zones
19/04	. . of rubber; of plastics material; of varnish		
19/06	. . of metal		
<b>21/00</b>	<b>Constructions of heat-exchange apparatus characterised by the selection of particular materials</b> {(coatings for modifying heat-transfer <a href="#">F28F 13/18</a> ; coatings for preventing the formation of deposits or corrosion <a href="#">F28F 19/02</a> )}	<b>27/00</b>	<b>Control arrangements or safety devices specially adapted for heat-exchange or heat-transfer apparatus</b> (control arrangements in general <a href="#">G05</a> )
21/003	. {for domestic or space-heating systems}	27/003	. {specially adapted for cooling towers}
21/006	. {of glass}	27/006	. {specially adapted for regenerative heat-exchange apparatus}
21/02	. of carbon, e.g. graphite	27/02	. for controlling the distribution of heat-exchange media between different channels ({static flow control means in header boxes <a href="#">F28F 9/026</a> }; arrangements of guide plates or guide vanes <a href="#">F28F 9/22</a> , <a href="#">F28F 25/12</a> )
21/04	. of ceramic; of concrete; of natural stone		
21/045	. . {for domestic or space-heating systems}	<b>99/00</b>	<b>Subject matter not provided for in other groups of this subclass</b>
21/06	. of plastics material	<b>2200/00</b>	<b>Prediction; Simulation; Testing</b> (measuring quantity of heat conveyed by flowing mediums <a href="#">G01K 17/06</a> )
21/061	. . {for domestic or space-heating systems}	2200/005	. Testing heat pipes
21/062	. . {the heat-exchange apparatus employing tubular conduits}	<b>2210/00</b>	<b>Heat exchange conduits</b>
21/063	. . . {for domestic or space-heating systems}	2210/02	. with particular branching, e.g. fractal conduit arrangements
21/065	. . {the heat-exchange apparatus employing plate-like or laminated conduits}	2210/04	. Arrangements of conduits common to different heat exchange sections, the conduits having channels for different circuits
21/066	. . . {for domestic or space-heating systems}	2210/06	. having walls comprising obliquely extending corrugations, e.g. in the form of threads
21/067	. . {Details}	2210/08	. Assemblies of conduits having different features
21/068	. . . {for domestic or space-heating systems}	2210/10	. Particular layout, e.g. for uniform temperature distribution
21/08	. of metal	<b>2215/00</b>	<b>Fins</b>
21/081	. . {Heat exchange elements made from metals or metal alloys}	2215/02	. Arrangements of fins common to different heat exchange sections, the fins being in contact with different heat exchange media
21/082	. . . {from steel or ferrous alloys}	2215/04	. Assemblies of fins having different features, e.g. with different fin densities
21/083	. . . . {from stainless steel}	2215/06	. Hollow fins; fins with internal circuits
21/084	. . . {from aluminium or aluminium alloys}	2215/08	. with openings, e.g. louvers ( <a href="#">zig-zag fins with openings F28F 1/128</a> , common transversal fins with openings <a href="#">F28F 1/325</a> , corrugated fins with openings <a href="#">F28F 3/027</a> )
21/085	. . . {from copper or copper alloys}	2215/10	. Secondary fins, e.g. projections or recesses on main fins
21/086	. . . {from titanium or titanium alloys}	2215/12	. with U-shaped slots for laterally inserting conduits
21/087	. . . {from nickel or nickel alloys}	2215/14	. in the form of movable or loose fins
21/088	. . {for domestic or space-heating systems}	<b>2220/00</b>	<b>Closure means, e.g. end caps on header boxes or plugs on conduits</b>
21/089	. . {Coatings, claddings or bonding layers made from metals or metal alloys ( <a href="#">F28F 19/06</a> takes precedence)}	<b>2225/00</b>	<b>Reinforcing means</b>
<b>23/00</b>	<b>Features relating to the use of intermediate heat-exchange materials, e.g. selection of compositions</b> (heat-transfer, heat-exchange or heat-storage materials <a href="#">C09K 5/00</a> )	2225/02	. for casings
23/02	. Arrangements for obtaining or maintaining same in a liquid state	2225/04	. for conduits
<b>25/00</b>	<b>Component parts of trickle coolers</b> (arrangements for increasing heat transfer <a href="#">F28F 13/00</a> ; controlling arrangements <a href="#">F28F 27/00</a> )	2225/06	. for fins
2025/005	. {Liquid collection; Liquid treatment; Liquid recirculation; Addition of make-up liquid}	2225/08	. for header boxes
25/02	. for distributing, circulating, and accumulating liquid (spraying or atomising in general <a href="#">B05B</a> , <a href="#">B05D</a> )	<b>2230/00</b>	<b>Sealing means</b>
25/04	. . Distributing or accumulator troughs		
25/06	. . Spray nozzles or spray pipes		
25/08	. . Splashing boards or grids, e.g. for converting liquid sprays into liquid films; Elements or beds for increasing the area of the contact surface (packing elements <a href="#">per se B01J 19/30</a> , <a href="#">B01J 19/32</a> )		

- 2235/00** Means for filling gaps between elements, e.g. between conduits within casings
- 2240/00** Spacing means
- 2245/00** Coatings; Surface treatments
- 2245/02 . hydrophilic
- 2245/04 . hydrophobic
- 2245/06 . having particular radiating, reflecting or absorbing features, e.g. for improving heat transfer by radiation
- 2245/08 . self-cleaning
- 2250/00** Arrangements for modifying the flow of the heat exchange media (in general [F28F 13/06](#)), e.g. flow guiding means (in casings [F28F 9/22](#)); Particular flow patterns
- 2250/02 . Streamline-shaped elements
- 2250/04 . Communication passages between channels
- 2250/06 . Derivation channels, e.g. bypass
- 2250/08 . Fluid driving means, e.g. pumps, fans
- 2250/10 . Particular pattern of flow of the heat exchange media
- 2250/102 . . with change of flow direction
- 2250/104 . . with parallel flow
- 2250/106 . . with cross flow
- 2250/108 . . with combined cross flow and parallel flow
- 2255/00** Heat exchanger elements made of materials having special features or resulting from particular manufacturing processes
- 2255/02 . Flexible elements
- 2255/04 . comprising shape memory alloys or bimetallic elements
- 2255/06 . composite, e.g. polymers with fillers or fibres
- 2255/08 . pressed; stamped; deep-drawn
- 2255/10 . made by hydroforming
- 2255/12 . expanded or perforated metal plate
- 2255/14 . molded
- 2255/143 . . injection molded
- 2255/146 . . overmolded
- 2255/16 . extruded
- 2255/18 . sintered
- 2255/20 . with nanostructures
- 2260/00** Heat exchangers or heat exchange elements having special size, e.g. microstructures ([microheat pipes F28D 2015/0225](#); [nanostructures F28F 2255/20](#))
- 2260/02 . having microchannels
- 2265/00** Safety or protection arrangements; Arrangements for preventing malfunction (control or monitoring devices [F28F 27/00](#))
- 2265/02 . in the form of screens or covers ([heat shields F28F 2265/10](#))
- 2265/06 . by using means for draining heat exchange media from heat exchangers
- 2265/10 . for preventing overheating, e.g. heat shields ([thermal insulation F28F 2270/00](#))
- 2265/12 . for preventing overpressure
- 2265/14 . for preventing damage by freezing, e.g. for accommodating volume expansion
- 2265/16 . for preventing leakage
- 2265/18 . for removing contaminants, e.g. for degassing
- 2265/20 . for preventing development of microorganisms
- 2265/22 . for draining
- 2265/24 . for electrical insulation
- 2265/26 . for allowing differential expansion between elements ([floating header box elements F28F 9/0236](#))
- 2265/28 . for preventing noise (by preventing vibrations [F28F 2265/30](#))
- 2265/30 . for preventing vibrations
- 2265/32 . for limiting movements, e.g. stops, locking means
- 2270/00** Thermal insulation; Thermal decoupling
- 2270/02 . by using blind conduits
- 2275/00** Fastening; Joining
- 2275/02 . by using bonding materials ([brazing F28F 2275/04](#)); by embedding elements in particular materials
- 2275/025 . . by using adhesives
- 2275/04 . by brazing ([brazing heat exchangers B23K 1/0012](#))
- 2275/045 . . with particular processing steps, e.g. by allowing displacement of parts during brazing or by using a reservoir for storing brazing material
- 2275/06 . by welding ([welding heat exchangers B23K 2101/14](#))
- 2275/061 . . by diffusion bonding
- 2275/062 . . by impact pressure or friction welding
- 2275/064 . . by induction welding or by using microwaves
- 2275/065 . . by ultrasonic or vibration welding
- 2275/067 . . by laser welding
- 2275/068 . . by explosive welding
- 2275/08 . by clamping or clipping
- 2275/085 . . with snap connection
- 2275/10 . by force joining
- 2275/12 . by methods involving deformation of the elements
- 2275/122 . . by crimping, caulking or clinching
- 2275/125 . . by bringing elements together and expanding
- 2275/127 . . by shrinking
- 2275/14 . by using form fitting connection, e.g. with tongue and groove
- 2275/143 . . with pin and hole connections
- 2275/146 . . with bayonet connections
- 2275/16 . with toothed elements, e.g. with serrations
- 2275/18 . by using wedge effect
- 2275/20 . with threaded elements
- 2275/205 . . with of tie-rods
- 2275/22 . by using magnetic effect
- 2280/00** Mounting arrangements; Arrangements for facilitating assembling or disassembling of heat exchanger parts
- 2280/02 . Removable elements
- 2280/04 . Means for preventing wrong assembling of parts
- 2280/06 . Adapter frames, e.g. for mounting heat exchanger cores on other structure and for allowing fluidic connections
- 2280/08 . Tolerance compensating means
- 2280/10 . Movable elements, e.g. being pivotable ([elements specially adapted for movements F28F 5/00](#))
- 2280/105 . . with hinged connections