

# SECTION F — MECHANICAL ENGINEERING; LIGHTING; HEATING; WEAPONS; BLASTING

## F28 HEAT EXCHANGE IN GENERAL

**F28F DETAILS OF HEAT-EXCHANGE OR HEAT-TRANSFER APPARATUS, OF GENERAL APPLICATION** (heat-transfer, heat-exchange or heat-storage materials C09K 5/00; water or air traps, air venting F16)

### Subclass index

#### DETAILS AND THEIR ARRANGEMENTS

Elements for heat exchange or transfer and assemblies thereof

tubular; plate-like; for movement; others.....1/00, 3/00, 5/00, 7/00

auxiliary supports for elements; sealing.....9/00, 11/00

Casings and header boxes.....9/00

Preventing deposits or corrosion.....17/00, 19/00

Special features of heat-exchange apparatus

characterised by the selection of: constructional material; intermediate heat-exchange material.....21/00, 23/00

component parts of trickle coolers.....25/00

MODIFYING HEAT-TRANSFER; CONTROL OF APPARATUS.....13/00, 27/00

SUBJECT MATTER NOT PROVIDED FOR IN OTHER GROUPS OF THIS SUBCLASS.....99/00

**1/00 Tubular elements; Assemblies of tubular elements**  
(specially adapted for movement  
F28F 5/00) [1, 2006.01]

1/02 • Tubular elements of cross-section which is non-  
circular (F28F 1/08, F28F 1/10 take  
precedence) [1, 2006.01]

1/04 • • polygonal, e.g. rectangular [1, 2006.01]

1/06 • • crimped or corrugated in cross-  
section [1, 2006.01]

1/08 • Tubular elements crimped or corrugated in  
longitudinal section [1, 2006.01]

1/10 • Tubular elements or assemblies thereof with means  
for increasing heat-transfer area, e.g. with fins, with  
projections, with recesses (crimped or corrugated  
elements F28F 1/06, F28F 1/08) [1, 2006.01]

1/12 • • the means being only outside the tubular  
element [1, 2006.01]

1/14 • • • and extending longitudinally (F28F 1/38 takes  
precedence) [1, 2006.01]

1/16 • • • • the means being integral with the element,  
e.g. formed by extrusion (F28F 1/22 takes  
precedence) [1, 2006.01]

1/18 • • • • • the element being built-up from finned  
sections [1, 2006.01]

1/20 • • • • • the means being attachable to the element  
(F28F 1/22 takes precedence) [1, 2006.01]

1/22 • • • • • the means having portions engaging further  
tubular elements [1, 2006.01]

1/24 • • • • and extending transversely (F28F 1/38 takes  
precedence) [1, 2006.01]

1/26 • • • • • the means being integral with the element  
(F28F 1/32 takes precedence) [1, 2006.01]

1/28 • • • • • the element being built-up from finned  
sections [1, 2006.01]

1/30 • • • • the means being attachable to the element  
(F28F 1/32 takes precedence) [1, 2006.01]

1/32 • • • • the means having portions engaging further  
tubular elements [1, 2006.01]

1/34 • • • • and extending obliquely (F28F 1/38 takes  
precedence) [1, 2006.01]

1/36 • • • • the means being helically-wound fins or  
wire spirals [1, 2006.01]

1/38 • • • • and being staggered to form tortuous fluid  
passages [1, 2006.01]

1/40 • • the means being only inside the tubular  
element [1, 2006.01]

1/42 • • the means being both outside and inside the  
tubular element [1, 2006.01]

1/44 • • • • and being formed of wire mesh [1, 2006.01]

**3/00 Plate-like or laminated elements; Assemblies of  
plate-like or laminated elements** (specially adapted for  
movement F28F 5/00) [1, 2006.01]

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) [1, 2006.01]

3/04 • • the means being integral with the  
element [1, 2006.01]

3/06 • • the means being attachable to the  
element [1, 2006.01]

3/08 • Elements constructed for building-up into stacks, e.g.  
capable of being taken apart for cleaning [1, 2006.01]

3/10 • • Arrangement for sealing the margins [1, 2006.01]

3/12 • Elements constructed in the shape of a hollow panel,  
e.g. with channels [1, 2006.01]

3/14 • • by separating portions of a pair of joined sheets to  
form channels, e.g. by inflation (manufacture  
thereof B23P) [1, 2006.01]

- 5/00 Elements specially adapted for movement** (arrangements for moving the elements, see the appropriate subclass for the apparatus concerned) [1, 2006.01]
- 5/02 • Rotary drums or rollers [1, 2006.01]
- 5/04 • Hollow impellers, e.g. stirring vane [1, 2006.01]
- 5/06 • Hollow screw conveyors [1, 2006.01]
- 7/00 Elements not covered by group F28F 1/00, F28F 3/00, or F28F 5/00** [1, 2006.01]
- 7/02 • Blocks traversed by passages for heat-exchange media [1, 2006.01]
- 9/00 Casings; Header boxes; Auxiliary supports for elements; Auxiliary members within casings** [1, 2006.01]
- 9/007 • Auxiliary supports for elements [6, 2006.01]
- 9/013 • • for tubes or tube-assemblies [6, 2006.01]
- 9/02 • Header boxes; End plates [1, 2006.01]
- 9/04 • • Arrangements for sealing elements into header boxes or end plates (joining pipes to walls in general F16L 41/00) [1, 2006.01]
- 9/06 • • • by dismountable joints [1, 2006.01]
- 9/08 • • • • by wedge-type connections, e.g. taper ferrule [1, 2006.01]
- 9/10 • • • • by screw-type connections, e.g. gland [1, 2006.01]
- 9/12 • • • • by flange-type connections [1, 2006.01]
- 9/14 • • • • by force-joining [1, 2006.01]
- 9/16 • • • by permanent joints, e.g. by rolling (metal-working procedures in general B21, B23, particularly B21D 39/06, B23K) [1, 2006.01]
- 9/18 • • • • by welding [1, 2006.01]
- 9/20 • Arrangements of heat reflectors, e.g. separately-insertible reflecting walls [1, 2006.01]
- 9/22 • Arrangements for directing heat-exchange media into successive compartments, e.g. arrangements of guide plates [1, 2006.01]
- 9/24 • Arrangements for promoting turbulent flow of heat-exchange media, e.g. by plates (F28F 1/38 takes precedence; in general F15D) [1, 2006.01]
- 9/26 • Arrangements for connecting different sections of heat-exchange elements, e.g. of radiators (connecting different sections in water heaters F24H 9/14) [1, 2006.01]
- 11/00 Arrangements for sealing leaky tubes or conduits** (stopping flow from or in pipes in general F16L 55/10) [1, 2006.01]
- 11/02 • using obturating elements, e.g. washers, inserted and operated independently of each other (F28F 11/06 takes precedence) [1, 2006.01]
- 11/04 • using pairs of obturating elements, e.g. washers, mounted upon central operating rods (F28F 11/06 takes precedence) [1, 2006.01]
- 11/06 • using automatic tube-obturating appliances [1, 2006.01]
- 13/00 Arrangements for modifying heat transfer, e.g. increasing, decreasing** (F28F 1/00-F28F 11/00 take precedence) [1, 2006.01]
- 13/02 • by influencing fluid boundary (boundary-layer control in general F15D) [1, 2006.01]
- 13/04 • by preventing the formation of continuous films of condensate on heat-exchange surfaces, e.g. by promoting droplet formation [1, 2006.01]
- 13/06 • by affecting the pattern of flow of the heat-exchange media [1, 2006.01]
- 13/08 • • by varying the cross-section of the flow channels [1, 2006.01]
- 13/10 • • by imparting a pulsating motion to the flow, e.g. by sonic vibration [1, 2006.01]
- 13/12 • • by creating turbulence, e.g. by stirring, by increasing the force of circulation (F28F 13/08 takes precedence) [1, 2006.01]
- 13/14 • by endowing the walls of conduits with zones of different degrees of conduction of heat [1, 2006.01]
- 13/16 • by applying an electrostatic field to the body of the heat-exchange medium [1, 2006.01]
- 13/18 • by applying coatings, e.g. radiation-absorbing, radiation-reflecting; by surface treatment, e.g. polishing [1, 2006.01]
- 17/00 Removing ice or water from heat-exchange apparatus** [1, 2006.01]
- 19/00 Preventing the formation of deposits or corrosion, e.g. by using filters** [1, 2006.01]
- 19/01 • by using means for separating solid materials from heat-exchange fluids, e.g. filters [6, 2006.01]
- 19/02 • by using coatings, e.g. vitreous or enamel coatings [1, 2006.01]
- 19/04 • • of rubber; of plastics material; of varnish [1, 2006.01]
- 19/06 • • of metal [1, 2006.01]
- 21/00 Constructions of heat-exchange apparatus characterised by the selection of particular materials** [1, 2006.01]
- 21/02 • of carbon, e.g. graphite [1, 2006.01]
- 21/04 • of ceramic; of concrete; of natural stone [1, 2006.01]
- 21/06 • of plastics material [1, 2006.01]
- 21/08 • of metal [1, 2006.01]
- 23/00 Features relating to the use of intermediate heat-exchange materials, e.g. selection of compositions** [1, 2006.01]
- 23/02 • Arrangements for obtaining or maintaining same in a liquid state [1, 2006.01]
- 25/00 Component parts of trickle coolers** (arrangements for increasing heat transfer F28F 13/00; controlling arrangements F28F 27/00) [1, 2006.01]
- 25/02 • for distributing, circulating, or accumulating liquid (spraying or atomising in general B05B, B05D) [1, 2006.01]
- 25/04 • • Distributing or accumulator troughs [1, 2006.01]
- 25/06 • • Spray nozzles or spray pipes [1, 2006.01]
- 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 in general B01J 19/30, B01J 19/32) [1, 2006.01]
- 25/10 • for feeding gas or vapour [1, 2006.01]
- 25/12 • • Ducts; Guide vanes, e.g. for carrying currents to distinct zones [1, 2006.01]
- 27/00 Control arrangements or safety devices specially adapted for heat-exchange or heat-transfer apparatus** [1, 2006.01]
- 27/02 • for controlling the distribution of heat-exchange media between different channels (arrangements of guide plates or guide vanes F28F 9/22, F28F 25/12) [1, 2006.01]
- 99/00 Subject matter not provided for in other groups of this subclass** [2006.01]