

## 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

<b>1/00</b>	<b>Tubular elements; Assemblies of tubular elements</b> (specially adapted for movement F28F 5/00)	1/34	• • • and extending obliquely (F28F 1/38 takes precedence)
1/02	• Tubular elements of cross-section which is non-circular (F28F 1/08, F28F 1/10 take precedence)	1/36	• • • the means being helically-wound fins or wire spirals
1/04	• • polygonal, e.g. rectangular	1/38	• • • and being staggered to form tortuous fluid passages
1/06	• • crimped or corrugated in cross-section	1/40	• • the means being only inside the tubular element
1/08	• Tubular elements crimped or corrugated in longitudinal section	1/42	• • the means being both outside and inside the tubular element
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)	1/44	• • • and being formed of wire mesh
1/12	• • the means being only outside the tubular element	<b>3/00</b>	<b>Plate-like or laminated elements; Assemblies of plate-like or laminated elements</b> (specially adapted for movement F28F 5/00)
1/14	• • • and extending longitudinally (F28F 1/38 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)
1/16	• • • the means being integral with the element, e.g. formed by extrusion (F28F 1/22 takes precedence)	3/04	• • the means being integral with the element
1/18	• • • • the element being built-up from finned sections	3/06	• • the means being attachable to the element
1/20	• • • • the means being attachable to the element (F28F 1/22 takes precedence)	3/08	• Elements constructed for building-up into stacks, e.g. capable of being taken apart for cleaning
1/22	• • • • the means having portions engaging further tubular elements	3/10	• • Arrangement for sealing the margins
1/24	• • • and extending transversely (F28F 1/38 takes precedence)	3/12	• Elements constructed in the shape of a hollow panel, e.g. with channels
1/26	• • • the means being integral with the element (F28F 1/32 takes precedence)	3/14	• • by separating portions of a pair of joined sheets to form channels, e.g. by inflation (manufacture thereof B23P)
1/28	• • • • the element being built-up from finned sections	<b>5/00</b>	<b>Elements specially adapted for movement</b> (arrangements for moving the elements, <u>see</u> the appropriate subclass for the apparatus concerned)
1/30	• • • • the means being attachable to the element (F28F 1/32 takes precedence)	5/02	• Rotary drums or rollers
1/32	• • • • the means having portions engaging further tubular elements	5/04	• Hollow impellers, e.g. stirring vane
		5/06	• Hollow screw conveyers

**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

**9/00 Casings; Header boxes; Auxiliary supports for elements; Auxiliary members within casings**

- 9/007 • Auxiliary supports for elements [6]  
 9/013 • • for tubes or tube-assemblies [6]  
 9/02 • Header boxes; End plates  
 9/04 • • Arrangements for sealing elements into header boxes or end plates (joining pipes to walls in general F16L 41/00)  
 9/06 • • • by dismountable joints  
 9/08 • • • • by wedge-type connections, e.g. taper ferrule  
 9/10 • • • • by screw-type connections, e.g. gland  
 9/12 • • • • by flange-type connections  
 9/14 • • • • by force-joining  
 9/16 • • • by permanent joints, e.g. by rolling (metal-working procedures in general B21, B23, particularly B21D 39/06, B23K)  
 9/18 • • • • by welding  
 9/20 • Arrangements of heat reflectors, e.g. separately-insertible reflecting walls  
 9/22 • Arrangements for directing heat-exchange media into successive compartments, e.g. arrangements of guide plates  
 9/24 • Arrangements for promoting turbulent flow of heat-exchange media, e.g. by plates (F28F 1/38 takes precedence; in general F15D)  
 9/26 • Arrangements for connecting different sections of heat-exchange elements, e.g. of radiators (connecting different sections in water heaters F24H 9/14)

**11/00 Arrangements for sealing leaky tubes or conduits (stopping flow from or in pipes in general F16L 55/10)**

- 11/02 • using obturating elements, e.g. washers, inserted and operated independently of each other (F28F 11/06 takes precedence)  
 11/04 • using pairs of obturating elements, e.g. washers, mounted upon central operating rods (F28F 11/06 takes precedence)  
 11/06 • using automatic tube-obturating appliances

**13/00 Arrangements for modifying heat transfer, e.g. increasing, decreasing (F28F 1/00-F28F 11/00 take precedence)**

- 13/02 • by influencing fluid boundary (boundary-layer control in general F15D)  
 13/04 • by preventing the formation of continuous films of condensate on heat-exchange surfaces, e.g. by promoting droplet formation  
 13/06 • by affecting the pattern of flow of the heat-exchange media  
 13/08 • • by varying the cross-section of the flow channels  
 13/10 • • by imparting a pulsating motion to the flow, e.g. by sonic vibration

- 13/12 • • by creating turbulence, e.g. by stirring, by increasing the force of circulation (F28F 13/08 takes precedence)

- 13/14 • by endowing the walls of conduits with zones of different degrees of conduction of heat

- 13/16 • by applying an electrostatic field to the body of the heat-exchange medium

- 13/18 • by applying coatings, e.g. radiation-absorbing, radiation-reflecting; by surface treatment, e.g. polishing

**17/00 Removing ice or water from heat-exchange apparatus****19/00 Preventing the formation of deposits or corrosion, e.g. by using filters**

- 19/01 • by using means for separating solid materials from heat-exchange fluids, e.g. filters [6]

- 19/02 • by using coatings, e.g. vitreous or enamel coatings

- 19/04 • • of rubber; of plastics material; of varnish

- 19/06 • • of metal

**21/00 Constructions of heat-exchange apparatus characterised by the selection of particular materials**

- 21/02 • of carbon, e.g. graphite

- 21/04 • of ceramic; of concrete; of natural stone

- 21/06 • of plastics material

- 21/08 • of metal

**23/00 Features relating to the use of intermediate heat-exchange materials, e.g. selection of compositions**

- 23/02 • Arrangements for obtaining or maintaining same in a liquid state

**25/00 Component parts of trickle coolers (arrangements for increasing heat transfer F28F 13/00; controlling arrangements F28F 27/00)**

- 25/02 • for distributing, circulating, or accumulating liquid (spraying or atomising in general B05B, B05D)

- 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 in general B01J 19/30, B01J 19/32)

- 25/10 • for feeding gas or vapour

- 25/12 • • Ducts; Guide vanes, e.g. for carrying currents to distinct zones

**27/00 Control arrangements or safety devices specially adapted for heat-exchange or heat-transfer apparatus**

- 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)

**99/00 Subject matter not provided for in other groups of this subclass [2006.01]**