

- 17 Refrigeration and ice-making, ice-storage, heat exchange, mechanical liquefaction of not easily condensable gases and gaseous mixtures**
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- 17a Refrigerating machines**
- 17b Preparation and production of ice**
- 17c Ice cellars, ice boxes and refrigerators, freezing equipment, refrigeration cars**
- 17d Steam condensers**
- 17e Open heat-exchange devices, in which the heat-exchange media come into direct contact**
- 17f Enclosed heat-exchange devices, in which the heat exchange media are separated by a solid wall**
- 17g Liquefaction and separation of not easily condensable gases and gaseous mixtures by mechanical means, decantation and vapourisation of liquefied gases; pressure containers and insulated containers for compressed and liquefied gases**
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- 17a Refrigerating machines**
- Compression refrigerating machines**
- 17a-1/01 General
- 17a-1/02 with liquid working agent
- 17a-1/03 with circulating steam as working agent
- 17a-1/04 Cooling of the compressor, also in conjunction with the motor and condenser
- 17a-1/05 Multistage compression-refrigerating machines
- 17a-2 Rotary compression-refrigerating machines
- 17a-3/01 Compressors, general, and their valve regulation (compressors 27; compressor valve structure 47g)
- 17a-3/02 Special kinds of compressors, e.g. compression effected by means of a liquid
- 17a-3/03 Rotary compressors
- 17a-3/04 Electrically driven compressors, and liquid driven by electrodynamic means
- 17a-4/01 Regulating devices for compression-refrigerating machines, general
- 17a-4/02 Electric regulation of compression-refrigerating machines
- 17a-4/03 Measurements applied to compression-refrigerating machines
- 17a-4/04 Float-regulation for compression-refrigerating machines
- 17a-5 Air refrigerating machines
- 17a-6 Vacuum refrigerating machines without circulation of the working agent
- 17a-7 Compression-absorption refrigerating machines
- Absorption-refrigerating machines, continuous operation
- 17a-8/01 General
- 17a-8/02 with inert gases
- 17a-8/03 Liquid driven by phenomena occurring in the process itself
- Absorption-refrigerating machines, discontinuous operation
- 17a-9/01 General
- 17a-9/02 Liquid seals
- 17a-9/03 Water separation

- 17a-9/04 Use of multiple generators
- 17a-9/05 Rotary periodic absorption-refrigerating machines
- 17a-10 Regulating and control devices for absorption-refrigerating machines
- 17a-11 Absorbers for absorption-refrigerating machines
- 17a-12 Stills: generators, generator-absorbers for absorption-refrigerating machines
- 17a-13/01 Evaporators, general
- 17a-13/02 Evaporators for ice making
- 17a-13/03 Condensers
- 17a-14 Regulating valves (valves 47g)
- 17a-15/01 Packings, general
- 17a-15/02 Diaphragm packings
- 17a-16 Lubrication and oil separators
- 17a-17/01 Liquid separators
- 17a-17/02 Deaerators
- 17a-18/01 Iceboxes in conjunction with compression-refrigerating machines (iceboxes 17c)
- 17a-18/02 Iceboxes in conjunction with absorption-refrigerating machines
- 17a-19 Special details
- 17a-20 Special refrigerating machines, also those using the Peltier effect
- 17a-21 Simultaneous production of cold and power, or of cold and heat
- 17b Preparation and production of ice (refrigerating machines 17a)**
- 17b-1 Ice making without the use of freezing cans, also preparation of natural ice
  - Ice making in freezing moulds
- 17b-2/01 General
- 17b-2/02 Filling devices for ice moulds
- 17b-2/03 Ice moulds structures
- 17b-2/04 Obtaining ice by means of freezing plates completely immersed in water
- 17b-2/05 Ice making in rotating ice moulds
- 17b-2/06 Continuous ice making
- 17b-3/01 Blowing air into ice cells
- 17b-3/02 Stirring mechanisms
- 17b-3/03 Preparation of water for freezing (85b)
- 17b-4/01 Ice saws, ice cutting and harvesting machines
- 17b-4/02 Ice crushing without sawing (34b-5)
- 17b-4/03 Ice cleaning machines
- 17b-4/04 Ice tongs
- 17b-4/05 Transporting devices for ice blocks
- 17b-4/06 Ice shaving machines
- 17b-4/07 Ice presses
- 17b-5/01 Artificial skating rinks (39b-26; 77b-19/10; 77b-20)
- 17b-5/02 Vacuum ice machines
- 17b-5/03 Miscellaneous ice-making processes
  - Ice cream manufacture (53I-13)
- 17b-6/01 Non-rotating containers without stirring devices, ice-cream storage
- 17b-6/02 Rotating and oscillating containers without stirring devices
- 17b-6/03 Containers with stirring devices, with rotating container or stirring devices
- 17b-6/04 Continuous ice-cream making; ice cream in the cooling drum
- 17b-6/05 Continuous ice-cream making: ice cream outside the cooling drum or on a moving, endless, cooled conveyor belt
- 17b-6/06 Making ice cream by means of carbon dioxide

17b-6/07 Devices for dispensing ice cream portions, packing of ice cream

**17c Ice cellars, ice boxes and refrigerators, freezing equipment, refrigeration cars**

17c-1/01 Ice storage chambers

17c-1/02 Ice cellars, ice houses (structural section 37f-2/03, 37f-5/10)

17c-2/01 Ice cabinets

17c-2/02 Ice boxes

17c-2/03 Special ice-cooled containers (insulating containers 34l-11/02)

**Refrigerators, cooling containers and freezing equipment, especially for foodstuffs, with refrigeration** (ice-cream manufacture 17b-6; cooling of margarine and edible fats during manufacture 53h-2; decomposition of solutions or fluid mixtures by cooling and crystallisation of constituents 12c-2)

17c-3/01 by means of cold water, e.g. domestic tap water (85d-2 – 85d-4)

17c-3/02 by means of refrigerating mixtures (refrigerating mixtures as such 12a-7)

17c-3/03 by means of liquefied gases (ice boxes in conjunction with refrigerating machines 17a-18/01 – 17a-18/02)

17c-3/04 by liquid evaporation (34f-20; 36d-1/10 – 36d-1/13)

17c-3/05 by means of standing or circulating brine

17c-3/06 by means of cold air, e.g. from the ground

17c-3/07 by means of carbon dioxide snow and ice: dry ice (carbon dioxide as such 12i-35, 12i-31/20)

17c-3/08 by means of other refrigerants or of several refrigerants simultaneously

17c-3/10 Air cooling and circulation in cold rooms (36d-1/01 – 36d-1/02; 36d-1/20; 36d-1/40)

17c-3/11 Cold accumulating

17c-3/12 Cold transfer by condensing and evaporating heat transfer media (17a, 1801)

**Refrigerator structural elements**

17c-4/01 Charging and discharging devices for cooling agents and goods

17c-4/02 Movable goods supports and containers

17c-4/03 Ice containers, ice and goods grids

17c-4/04 Refrigerator cabinet lids, doors and their locks (37d-18 – 37d-24)

17c-4/05 Refrigerator cabinet walls (insulated walls 37a, 37b; insulating materials 39b, 80b)

17c-4/06 Collapsible refrigerator cabinets

17c-4/07 Regulating devices for refrigerators (42i)

17c-4/10 Miscellaneous structural elements, e.g. coils and fittings

**Refrigeration cars** (20c-10; 20c-24; 63a-37; 63c-43)

17c-5/01 Ice-cooled

17c-5/02 Brine-cooled

17c-5/03 with evaporation cooling

17c-5/04 with air circulation

17c-5/05 with gas cooling

**17d Steam condensers** (12a-6; 14e-13; 14g-12; 17a-13/03; 89e-5)

Surface condensers

17d-1/01 with water as a coolant

17d-1/02 with air as a coolant

17d-1/03 with other coolants, e.g. cooling liquids or several refrigerants simultaneously

17d-1/04 Form of the cooling surfaces (17f)

17d-1/05 Cooling tube fastening, packing and support, tube flexibility (17f-5/03; 17f-5/04)

17d-1/06 Double-walled tubes

- Mixing condensers
- 17d-2/01 Injector condensers
- 17d-2/02 Water jet condensers
- 17d-2/03 Steam jet condensers
- 17d-3/01 Trickle condensers (17e-1 – 17e-3; 17f-3)
- 17d-3/02 Evaporation trickle condensers (17e-6/03; 17f-3/07)
- 17d-4/01 Rotary surface condensers (17f-10)
- 17d-4/02 Rotary mixing condensers (17e-5)
- 17d-4/03 Rotary open-surface and evaporation condensers
- Components of condensers
- 17d-5/01 Feed, conveyance and distribution of steam
- 17d-5/02 Conveyance, distribution and collection or accumulation of the cooling water
- 17d-5/03 Re-cooling of the cooling water (17e-1 – 17e-3)
- 17d-5/04 Collection and discharge of the condensate, e.g. by means of piston and moist-air pumps, fractional discharge
- 17d-5/05 Evacuation and cooling of the non-condensable gases, e.g. by means of piston, centrifugal or jet pumps, with or without after-condensers
- 17d-5/10 Auxiliary condensers
- 17d-5/11 Cleaning and anticorrosive protection of condensers
- Regulation by acting upon
- 17d-5/12 the cooling water, also injector and trickle water
- 17d-5/13 the condensate
- 17d-5/14 the steam
- 17d-5/15 the vacuum, e.g. vacuum breakers
- 17d-5/16 Condenser starting procedures and connections
- 17d-5/17 Connection and drive of the pump sets for water, condensate, air
- 17d-5/20 Special condenser structures and arrangements
- 17d-6 Condensers for cold steam machines (14h-6)
- 17d-7/01 Combination of several of the aforementioned condensation systems
- 17d-7/02 Special condensation systems
- 17e**
- Open heat-exchange devices, in which the heat-exchange media come into direct contact**
- Open trickle coolers for liquids and gases**
- 17e-1 Cooling towers
- Cooling towers as counter-current trickle coolers, general structure
- 17e-2/01 with natural ventilation
- 17e-2/02 with artificial ventilation, also fans driven by circulating water
- 17e-2/03 with natural and artificial ventilation
- Cooling towers as cross-current trickle coolers, general structure
- 17e-2/05 with natural ventilation
- 17e-2/06 with artificial ventilation, also with air circulation
- 17e-2/07 with natural and artificial ventilation
- 17e-2/10 Cross-current-counter-current cooling towers
- 17e-2/11 Compartmented cooling towers, combined counter-and cross-current coolers
- Components of cooling towers
- 17e-2/20 Water distribution and accumulation, distributing channels and accumulator troughs
- 17e-2/21 Air feed, guiding devices
- 17e-2/22 Structural trickle systems and filler elements

- 17e-2/23 Core ventilation media for structural elements  
 17e-2/24 Media to prevent icing and soiling of the elements  
 17e-2/25 Tower linings  
 17e-2/26 Special draft-increasing media, e.g. by warming the outgoing air  
 17e-2/27 Water circulation and conveyance, also replacement water supply
- Regulation by acting upon  
 17e-2/30 the water  
 17e-2/31 the air: change to artificial or natural ventilation  
 17e-2/32 Heat recovery from the exhaust steam
- 17e-3 Special trickle coolers with natural and artificial air draft  
 17e-4/01 Spray coolers, general structure inclusive of air filtration devices  
 17e-4/02 Spray nozzles, spray tubes  
 17e-4/03 Splash plates baffle plates
- Movable open coolers (17d-4/02; 17f-10)  
 17e-5/01 with movable distributor, general structure  
 17e-5/02 with rotating disks or drums, ventilation coolers  
 17e-5/03 with endless belts or chains  
 17e-5/04 with reciprocating distributors
- Coolers for air cooling (36d-1/01)  
 17e-6/01 by direct contact with ice and ice water (17c-3/10)  
 17e-6/02 by direct contact with liquid refrigerant and liquefied gases  
 17e-6/03 Evaporation coolers (17d-3/02; 17f-3/07)
- 17e-7 Special open heat-exchange devices for liquids and gases, e.g. parallel-flow coolers  
 17e-8 Open coolers for solid substances in general
- 17f Enclosed heat-exchange devices, in which the heat exchange media are separated by a solid wall**
- Beverage and liquid coolers (6b-15; 6b-18; 53e; 64c-14)  
 17f-2/01 as simple tubular coolers  
 17f-2/02 as cooling containers, tanks, vats, also with circulation of liquid  
 17f-2/03 as double-tube and multi-tubular coolers
- Trickle coolers  
 17f-3/01 with trickle tubes and tubular elements  
 17f-3/03 with smooth and corrugated trickle bells and terraced trickle surfaces  
 17f-3/05 Dismantling of trickle elements for cleaning  
 17f-3/06 Devices for the distribution of the trickling liquid and decrease of the rate of flow  
 17f-3/07 Evaporation trickle coolers (17e-6/03; 17d-3/02)
- Spiral and helical coolers  
 17f-4/01 with spiral and helical tubular coils  
 17f-4/02 with spiral-shaped bent plates  
 17f-4/03 Plates with spiral-shaped channels  
 17f-4/04 Containers with helical channels
- Counter current tubular coolers  
 17f-5/01 with vertical and horizontal tube nests arranged between tube sheets  
 17f-5/02 with tube bundles of special design and arrangement  
 17f-5/03 Arrangement and packing of the tubes, support for tubes and tube nests (17d-1/05)  
 17f-5/04 Movable arrangement of tubes and tube sheets to compensate for changes in length  
 17f-5/05 Special tube shapes and sections, e.g. flat rectangular, square tubes

- 17f-5/06 Guides for the heat-exchange media in and outside of the tubes, e.g. displacement bodies, intermediate walls
- 17f-5/07 Tubes with longitudinal fins
- 17f-5/08 Coolers with concentrically arranged shells
- 17f-5/09 Circulating and distributing devices for the heat exchange media
- 17f-5/10 Coolers with tubes fixed laterally to the tube sheet, e.g. U-shaped and tubes closed on one side
- 17f-5/11 Cleaning of tubular coolers, e.g. by dismantling the tubes or tube bundles, cleaning covers
  - Cross-current tubular coolers (46c4-8 – 46c4-11)
- 17f-5/20 General structure, tube mounting and packing
- 17f-5/21 Special arrangement of tubes and tube elements, e.g. staggered or in line
- 17f-5/22 Special tube shapes and sections, e.g. oval or elliptical
- 17f-5/23 Tubes with transverse fins
- 17f-5/24 Guiding surfaces and structural arrangements between the tubes
- 17f-5/30 Plate coolers (24k-4)
- 17f-5/31 Laminated coolers (46c4-9)
- 17f-5/32 Multi-element coolers made of sheet metal (36c-9)
- 17f-5/33 Plate elements with ribs
- 17f-5/34 Cooling element assemblies: group or columns
- 17f-6/01 Air and gas coolers (36d-1/01)
- 17f-6/02 Cooling air purifiers (36d-1/20)
- 17f-6/03 Circulation coolers with re-coolers
  - Coolers with defrosters
- 17f-7/01 by mechanical, chemical, electrical means
- 17f-7/02 by connecting the cooling tubes to a heated agent
- 17f-7/03 by reversing the refrigerant current or the air current, or both
- 17f-8 Pocket coolers (24k-4)
- 17f-9 Coolers moved through cooling water (6b-15; 6b-18)
  - Mechanically driven coolers (17b-6; 17d-4; 17e-5; 53h-2)
- 17f-10/01 with centrifugal disks and rotating drums and containers, fan coolers
- 17f-10/02 with movable or rotating distributors or agitators
- 17f-10/03 with reciprocating or rotating tubes
- 17f-11 Miscellaneous enclosed heat-exchange devices (13a; 13b; 17c-2 – 17c-4; 36e)
  - Special equipment for enclosed heat-exchange devices
- 17f-12/01 Regulation of heat exchange, e.g. according to quantity, temperature, pressure (36c-11; 42q; 42e)
- 17f-12/02 Distribution and change of flow of the heat-exchange agent, fixed and variable connections (17d-5/02)
- 17f-12/03 Means for producing turbulence in, and dispersion of the heat-exchange agent, especially on the heat-exchange wall, destruction of the boundary layer
- 17f-12/04 Coolers with variable flow section
- 17f-12/05 Welded coolers
- 17f-12/06 Special construction materials for coolers
- 17f-12/07 Coolers with accumulation (13g-2/03; 24c-5; 24k-4; 36b-4)
- 17f-12/08 Corrosion protection for coolers (17d-5/11)
- 17f-12/09 Special arrangement and design of the ribs on heat-exchange surfaces, e.g. as grids
- 17f-12/10 Special processes for increasing the heat exchange
- 17f-13 Direct-fired heaters for liquid or gaseous media of general applicability (heaters for special purposes, see the special classes; combustion apparatus in general 24)

- 17g            Liquefaction and separation of not easily condensable gases and gaseous mixtures by mechanical means, decantation and vaporisation of liquefied gases; pressure containers and insulated containers for compressed and liquefied gases**
- 17g-1            Liquefaction of not easily condensable gases and gaseous mixtures (12i; compressed illuminating gas 26a-18/10)
- Separation of liquefied gas mixtures (12i; 26a-18/11)
- 17g-2/01        by rectification
- 17g-2/02        by partial condensation
- 17g-2/03        Cold exchangers and accumulators for liquefaction and decomposition apparatus
- 17g-2/04        De-icing of liquefaction and decomposition apparatus
- 17g-3            Pressure containers for compressed and liquefied gases (4c-34, 20c-9; containers and fillers for acetylene solution holders 26b-44, 47f-21; gas bottle valves 47g-3; safety valves and devices 47g-47; pressure-reducing valves for gas bottles 47g-48, 64c-7, 85a-4)
- 17g-4            Insulated containers for liquefied gases (81c-27; containers with heat insulation, general, and as domestic appliances 34l-11; industrial glass manufacturing processes 32a-8, 32a-15, 32a-27, 32a-9/00, 32a-11/00, 32a-23/00, 32b-10, 32b-17/00; ceramics manufacturing processes 80a-46; containers for blasting cartridges 78e-5)
- 17g-5/01        Decantation, general
- 17g-5/02        Decantation and vaporisation of liquefied gases