F17C
VESSELS FOR CONTAINING OR STORING COMPRESSED, LIQUEFIED OR SOLIDIFIED GASES; FIXED-CAPACITY GAS-HOLDERS; FILLING VESSELS WITH, OR DISCHARGING FROM VESSELS, COMPRESSED, LIQUEFIED, OR SOLIDIFIED GASES (storing fluids in natural or artificial cavities or chambers in the earth B65G 5/00; construction or assembling of bulk storage containers employing civil-engineering techniques E04H 7/00; variable-capacity gas-holders F17B; liquefaction or refrigeration machines, plants, or systems F25)

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 Pressure vessels, e.g. gas cylinder, gas tank, replaceable cartridge (pressurised apparatus for purposes other than storage, see the relevant subclasses such as A62C, B05B; associated with vehicles, see the appropriate subclass of classes B60 - B64; pressure vessels in general F16J 12/00; autowaves B01J 3/04; tank vehicles B60P 3/22; railway tank wagons for carrying fluid materials B61D 5/00; accumulators for supplying fluid under pressure F15B 1/04; liquefied gas stoves F24C 3/00))

3/02 . with provision for thermal insulation (thermal insulation in general F16L 5/00; refrigerators F25D; insulation specially adapted for cryogenic vessels F17C 13/00; tank vehicles B60P 3/22; railway tank wagons B61D 5/00)

3/022 . [Land-based bulk storage containers (civil engineering aspects E04H 7/00)]

3/025 . [Bulk storage in barges or on ships (constructive aspects B63B 25/16)]

3/027 . . . [Wallpanels for so-called membrane tanks]

3/04 . . by insulating layers (F17C 3/08 takes precedence)

3/06 . . . on the inner surface, i.e. in contact with the stored fluid

3/08 . . by vacuum spaces, e.g. Dewar flask (for household use A47J 41/02)

3/085 . . . [Cryostats]

3/10 . . by liquid-circulating or vapour-circulating jackets

3/12 . . with provision for protection against corrosion, e.g. due to gaseous acid (protection against corrosion in general C23F)

5/00 Methods or apparatus for filling containers with liquefied, solidified, or compressed gases under pressures (adding propellants to aerosol containers B65B 31/00)

NOTE
This group includes not only the filling of vessels for storage of compressed or liquefied gases, but also the filling of pressurised apparatus insofar as it is not covered by a single other subclass, e.g. A62C, B05B.

5/002 . [Automated filling apparatus]

5/005 . . . [for gas bottles, such as on a continuous belt or on a merry-go-round]

5/007 . . . [for individual gas tanks or containers, e.g. in vehicles (filling with liquid fuel not under pressure, B60S 5/02, B67D 7/00)]
Methods and apparatus for filling vessels not under pressure with liquefied or solidified gases

Details of vessels or of the filling or discharging of vessels

Use of gas-solvents or gas-sorbents in vessels

Methods and apparatus for discharging liquefied, solidified, or compressed gases from pressure vessels, not covered by another subclass

Methods or apparatus for discharging liquefied or solidified gases from vessels not under pressure

Details of vessels or of the filling or discharging of vessels

Vessel construction, in particular geometry, arrangement or size

Arrangement or mounting of valves (valves per se F16K; snap-coupling of nipples F16L 37/00)

Arrangement or mounting of devices for preventing or minimising the effect of explosion

Arrangements for preventing freezing

Monitoring equipment (measuring in general G01)

Reinforcing or suspension means

Mounting arrangements for vessels

Closures, e.g. cap, breakable member (for autoclaves B01J 3/03); closures for (large) containers in general B65D [B65D 90/54]; (for pressure vessels in general F16J 13/00)

Mounting arrangements for vessels
Thermal insulations

Materials for walls or layers thereof

Wall structures; Special features thereof

by vacuum
by gas
by liquid means
by solid means
cooled by external means
cooled by vapourised gas from the interior

Multi-sheet layers

Aerogel

Foam

Polyurethane

Granular

Perlite

Wood

in form of panels

in form of fibers or filaments

Steel

Non-magnetic steels

Vessels with pre-constrained walls

Single wall

with one layer

with two layers

with three layers

with four or more layers

Multiple walls

Two walls

Three or more walls

Materials for walls or layers thereof

Wall structures; Special features thereof

Liners

Coatings

Straps, bands or ribbons

Wall structures

Single wall

with one layer

with two layers

with three layers

with four or more layers

Multiple walls

Two walls

Materials for walls or layers thereof

Metals

Steel

Non-magnetic steels

Stainless steels

Aluminium

Alloys or compositions of metals

Invar

Lead

in form of filaments

Synthetics

Plastics

in form of fibers or filaments

radially wound

axially wound

helically wound

Polymers

with details of composition

Concrete

Special properties of materials for vessel walls

flexible

superconducting

Break point in the wall

transparent

pre-constrained

comprising nanoparticles

Vessel construction, in particular mounting arrangements, attachments or identifications means

Mounting arrangements

Exterior arrangements

Frames

Boxes

Dismountable protective hulls

Vessel walls form part of another structure

characterised by number of vessels

One vessel

Two or more vessels

characterised by the presence of fluid connection between vessels

bundled in series

bundled in parallel

with details of the manifold

Vessel mounted inside another one

Details of mounting arrangements

for transport

with wheels

with handgrip

stackable

lockable

with ventilation

Supporting feet

Attachments to the ground, e.g. mooring or anchoring

Hanging up devices

with external bearing means

with shock absorbing means

Fluid connections, filters, valves, closure means or other attachments

Fittings, valves, filters, or components in connection with the gas storage device

Basses, e.g. boss collars

Protective caps

Closure means

breakable, e.g. with burst discs

fusing or melting

pierceable

Valves

electrically actuated

manually actuated

Safety valves or pressure relief valves

Check-valves or non-return valves

Pressure regulators

Filters

Sinter type
**Vessel construction, in particular methods of manufacturing**

- Shaping processes
- Moulding
- by injection
- by blowing
- using wax moulds
- by rotation
- Winding
- with a mandrel
- Polishing
- Metal working processes, e.g. deep drawing, stamping or cutting
- Working processes for non metal materials, e.g. extruding
- Assembling processes
- Welding
- by friction
- Press-fitting; Shrink-fitting
- Spraying
- by adhesive means
- by screws, bolts or rivets
- Manufacturing of particular parts or at special locations
- of walls
- of closing end pieces, e.g. caps
- Apparatus therefore
- Filling of insulants

**Handled fluid, in particular type of fluid**

- Pure fluids
- Oxgen
- Hydrogen
- Carbone dioxide
- Nitrogen
- Carbon monoxide
- Noble gases (Ar, Kr, Xe)

**Fluid contained in the vessel: Filling and discharging the fluid**

- Handled fluid before transfer, i.e. state of fluid when stored in the vessel or before transfer from the vessel
- Characterised by the phase
- Single phase
- dense or supercritical, i.e. at high pressure and high density
- gaseous, e.g. CNG, GNC
- liquid
- solid
- Two-phase
- Liquefied gas, e.g. LPG, GPL
- cryogenic, e.g. LNG, GNL, PLNG
- subcooled
- Solids and gas
- Liquids and solids
- Three-phase, e.g. CO₂ at triple point
- characterised by the pressure level
- Not under pressure, i.e. containing liquids or solids only
- Small pressure, e.g. for liquefied gas
- High pressure (>10 bar)
- Very high pressure (>80 bar)
- Subatmospheric pressure
- characterised by other properties of handled fluid before transfer
- Stratification
- Localisation of the removal point
- in the gas
- with a dip tube
- in the liquid
- with a dip tube
- in the solid

**Handled fluid after transfer, i.e. state of fluid after transfer from the vessel**

- characterised by the phase
- Single phase
- dense or supercritical, i.e. at high pressure and high density
- gaseous, e.g. CNG, GNC
- liquid
- solid
- Two-phase
- Liquefied gas, e.g. LPG, GPL
- cryogenic, e.g. LNG, GNL, PLNG
Fluid contained in the vessel; Filling and discharging the fluid

2227/0169 . . . . subcooled
2227/0176 . . . . Solids and gas
2227/0184 . . . . Liquids and solids
2227/0192 . . . . Three-phase, e.g. CO₂ at triple point
2227/0203 . . . . characterised by the pressure level
2227/031 . . . . Not under pressure, i.e. containing liquids or solids only
2227/033 . . . . Small pressure, e.g. for liquefied gas
2227/035 . . . . High pressure, i.e. between 10 and 80 bars
2227/036 . . . . Very high pressure, i.e. above 80 bars
2227/038 . . . . Subatmospheric pressure
2227/04 . . . . characterised by other properties of handled fluid after transfer
2227/041 . . . . Stratification
2227/042 . . . . Localisation of the filling point
2227/043 . . . . in the gas
2227/044 . . . . at several points, e.g. with a device for recondensing gas
2227/045 . . . . with a dip tube
2227/046 . . . . in the liquid
2227/047 . . . . with a dip tube
2227/048 . . . . in the solid

2227/00 Transfer of fluids, i.e. method or means for transferring the fluid; Heat exchange with the fluid

2227/01 . . . . Propulsion of the fluid
2227/0107 . . . . by pressurising the ullage
2227/0114 . . . . with vacuum injectors, e.g. venturi
2227/0121 . . . . by gravity
2227/0128 . . . . with pumps or compressors
2227/0135 . . . . Pumps
2227/0142 . . . . with specified pump type, e.g. piston or impulsive type
2227/015 . . . . with cooling of the pump
2227/0157 . . . . Compressors
2227/0164 . . . . with specified compressor type, e.g. piston or impulsive type
2227/0171 . . . . Arrangement
2227/0178 . . . . in the vessel
2227/0185 . . . . comprising several pumps or compressors
2227/0192 . . . . by using a working fluid
2227/03 . . . . Heat exchange with the fluid
2227/0302 . . . . by heating
2227/0304 . . . . using an electric heater
2227/0306 . . . . using the same fluid
2227/0309 . . . . using another fluid
2227/0311 . . . . Air heating
2227/0313 . . . . by forced circulation, e.g. using a fan
2227/0316 . . . . Water heating
2227/0318 . . . . using seawater
2227/032 . . . . using geothermal water
2227/0323 . . . . in a closed loop
2227/0325 . . . . by expansion using "Joule-Thompson" effect
2227/0327 . . . . with recovery of heat
2227/033 . . . . using solar energy
2227/0332 . . . . by burning a combustible
2227/0334 . . . . by radiation means
2227/0337 . . . . by cooling
2227/0339 . . . . using the same fluid
2227/0341 . . . . using another fluid
2227/0344 . . . . Air cooling
2227/0346 . . . . by forced circulation, e.g. using a fan
2227/0348 . . . . Water cooling
2227/0351 . . . . using seawater
2227/0353 . . . . using cryocooler
2227/0355 . . . . in a closed loop
2227/0358 . . . . by expansion
2227/036 . . . . "Joule-Thompson" effect
2227/0362 . . . . in a turbine
2227/0365 . . . . with recovery of heat
2227/0367 . . . . Localisation of heat exchange
2227/0369 . . . . in or on a vessel
2227/0372 . . . . in the gas
2227/0374 . . . . in the liquid
2227/0376 . . . . in wall contact
2227/0379 . . . . inside the vessel
2227/0381 . . . . integrated in the wall
2227/0383 . . . . outside the vessel
2227/0386 . . . . with a jacket
2227/0388 . . . . separate
2227/039 . . . . on the pipes
2227/0393 . . . . using a vapouriser
2227/0395 . . . . using a submersed heat exchanger
2227/0397 . . . . characterised by fins
2227/04 . . . . Methods for emptying or filling
2227/041 . . . . vessel by vessel
2227/042 . . . . with change-over from one vessel to another
2227/043 . . . . by pressure cascade
2227/044 . . . . by purging
2227/045 . . . . by vacuum
2227/046 . . . . by even emptying or filling
2227/047 . . . . by repeating a process cycle
2227/048 . . . . by maintaining residual pressure
Fluid contained in the vessel; Filling and discharging the fluid

2260/0486 . . . Indicating or measuring characterised by the location
2260/0491 . . . Parameters measured at or inside the vessel
2260/0495 . . . the indicated parameter is a converted measured parameter
2260/06 . . . Controlling or regulating of parameters as output values
2260/0605 . . . Parameters
2260/0606 . . . Level of content in the vessel
2260/0615 . . . Mass or weight of the content of the vessel
2260/0621 . . . Volume
2260/0626 . . . Pressure
2260/0631 . . . Temperature
2260/0636 . . . Flow or movement of content
2260/0642 . . . Composition; Humidity
2260/0647 . . . Concentration of a product
2260/0652 . . . Calorific or heating value
2260/0657 . . . Humidity
2260/0663 . . . Vibrations, e.g. of acoustic type
2260/0668 . . . Constraints, e.g. by gauges
2260/0673 . . . Time or time periods
2260/0678 . . . Position or presence
2260/0684 . . . Acceleration
2260/0689 . . . Methods for controlling or regulating
2260/0694 . . . with calculations
2260/0707 . . . Actions triggered by measured parameters
2260/072 . . . Action when predefined value is reached
2260/075 . . . when full
2260/077 . . . when empty

2260/00 Purposes of gas storage and gas handling
2260/01 . . . Improving mechanical properties or manufacturing
2260/011 . . . Improving strength
2260/012 . . . Reducing weight
2260/013 . . . Reducing manufacturing time or effort
2260/015 . . . Facilitating maintenance
2260/016 . . . Preventing slosh
2260/017 . . . by calculation
2260/018 . . . Adapting dimensions
2260/02 . . . Improving properties related to fluid or fluid transfer
2260/021 . . . Avoiding overpressurising
2260/022 . . . Avoiding overfilling
2260/023 . . . Avoiding overheating
2260/024 . . . Improving metering
2260/025 . . . Reducing transfer time
2260/026 . . . by calculation
2260/027 . . . Making transfer independent of vessel orientation
2260/028 . . . Avoiding unauthorised transfer
2260/03 . . . Dealing with losses
2260/031 . . . due to heat transfer
2260/032 . . . Avoiding freezing or defrosting
2260/033 . . . by enhancing insulation
2260/035 . . . of fluid
2260/036 . . . Avoiding leaks
2260/037 . . . Handling leaked fluid
2260/038 . . . Detecting leaked fluid
2260/04 . . . Reducing risks and environmental impact
2260/042 . . . Reducing risk of explosion
2260/044 . . . Avoiding pollution or contamination
2260/046 . . . Enhancing energy recovery
2260/048 . . . Refurbishing
2260/05 . . . Improving chemical properties
2260/053 . . . Reducing corrosion
2260/056 . . . Improving fluid characteristics

Purposes or effects

2265/00 Effects achieved by gas storage or gas handling
2265/01 . . . Purifying the fluid
2265/012 . . . by filtering
2265/015 . . . by separating
2265/017 . . . different phases of a same fluid
2265/02 . . . Mixing fluids
2265/022 . . . identical fluid
2265/025 . . . different fluids
2265/027 . . . with odorizing
2265/03 . . . Treating the boil-off
2265/031 . . . by discharge
2265/032 . . . by recovery
2265/033 . . . with cooling
2265/034 . . . with condensing the gas phase
2265/035 . . . with subcooling the liquid phase
2265/036 . . . with heating
2265/037 . . . with pressurising
2265/038 . . . with expanding
2265/04 . . . using an independent energy source, e.g. battery
2265/05 . . . Regasification
2265/06 . . . Fluid distribution
2265/061 . . . for supply of supplying vehicles
2265/063 . . . for supply of refueling stations
2265/065 . . . for refueling vehicle fuel tanks
2265/066 . . . for feeding engines for propulsion
2265/068 . . . Distribution pipeline networks
2265/07 . . . Generating electrical power as side effect

2270/00 Applications
2270/01 . . . for fluid transport or storage
2270/0102 . . . on or in the water
2270/0105 . . . Ships
2270/0107 . . . Wall panels
2270/011 . . . Barges
2270/0113 . . . floating
2270/0115 . . . immersed
2270/0118 . . . Offshore
2270/0121 . . . Platforms
2270/0123 . . . Terminals
2270/0126 . . . Buoys
2270/0128 . . . Storage in depth
2270/0131 . . . Submarines
2270/0134 . . . placed above the ground
2270/0136 . . . Terminals
2270/0139 . . . Fuel stations
2270/0142 . . . placed underground
2270/0144 . . . Type of cavity
2270/0147 . . . by burying vessels
2270/0149 . . . by digging cavities
2270/0152 . . . Salt caverns
2270/0155 . . . by using natural cavities
2270/0157 . . . Location of cavity
2270/016 . . . onshore
2270/0163 . . . offshore
Purposes or effects

- on the road
- by vehicles
- Trucks
- Railways
- Buses
- Cars
- Airbags
- Fuel cells
- in the air or in space
- Planes
- Hot air balloons
- for use under microgravity conditions, e.g. space
- Rockets
- for medical applications
- Breathing
- for industrial use
- "Dewar" vessels
- Semiconductors
- Superconductors
- Magnetic resonance imaging
- Tools
- Hydraulic applications
- Pneumatic applications
- Isostatic presses
- Power plants
- Mass bottling, e.g. merry belts
- for household use
- Camping gas
- Aerosols
- Thermos flasks
- Capsules, e.g. \( \text{CO}_2 \)
- Gas bottles
- Fire extinguishers
- Fuel cells
- Inflation devices, e.g. for rescue vests or tyres
- Diving equipments
- Respiration devices for resucing