

CPC COOPERATIVE PATENT CLASSIFICATION

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

LIGHTING; HEATING

F22 STEAM GENERATION (NOTE omitted)

F22B METHODS OF STEAM GENERATION; STEAM BOILERS (steam engine plants where engine aspects predominate [F01K](#); domestic central-heating systems using steam [F24D](#); heat exchange or heat transfer in general [F28](#); generation of vapour in the cores of nuclear reactors [G21](#))

NOTE

This subclass covers only methods of, or apparatus for, the generation of steam under pressure for heating or power purposes

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.

General aspects of, or methods for, steam generation

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| <p>1/00 Methods of steam generation characterised by form of heating method (solar heating F24S; jackets or other cooling means in which steam is generated and which serve for cooling other apparatus, see the subclasses for such apparatus)</p> <p>1/003 . {using combustion of hydrogen with oxygen (power plants using steam created by combustion of hydrogen with oxygen F01K 25/005)}</p> <p>1/006 . {using solar heat (solar heat collectors per se F24S; devices for producing mechanical power from solar energy F03G 6/00)}</p> <p>1/02 . by exploitation of the heat content of hot heat carriers</p> <p>1/021 . . {with heating tubes in which flows a non-specified heating fluid (for nuclear reactors F22B 1/023, for hot gas F22B 1/1884)}</p> <p>1/023 . . {with heating tubes, for nuclear reactors as far as they are not classified, according to a specified heating fluid, in another group}</p> <p>1/025 . . . {with vertical U shaped tubes carried on a horizontal tube sheet}</p> <p>1/026 . . . {with vertical tubes between to horizontal tube sheets}</p> <p>1/028 . . {Steam generation using heat accumulators (F22B 27/14 takes precedence)}</p> <p>1/04 . . the heat carrier being hot slag, hot residues, or heated blocks, e.g. iron blocks</p> <p>1/06 . . the heat carrier being molten; Use of molten metal, e.g. zinc, as heat transfer medium</p> <p>1/063 . . . {for metal cooled nuclear reactors (heat-exchangers having a liquid metal as heat exchange medium F28D7/00C)}</p> | <p>1/066 {with double-wall tubes having a third fluid between these walls, e.g. helium for leak detection (heat-exchangers with double-wall tubes F28D 7/10; double-wall pipes per se F16L 9/18)}</p> <p>1/08 . . the heat carrier being steam</p> <p>1/10 . . . released from heat accumulators</p> <p>1/12 . . . produced by an indirect cyclic process</p> <p>1/123 {Steam generators downstream of a nuclear boiling water reactor}</p> <p>1/126 {Steam generators of the Schmidt-Hartmann type}</p> <p>1/14 . . . coming in direct contact with water in bulk or in sprays</p> <p>1/143 {in combination with a nuclear installation}</p> <p>1/146 {Loffler boilers}</p> <p>1/16 . . the heat carrier being hot liquid or hot vapour, e.g. waste liquid, waste vapour</p> <p>1/162 . . . {in combination with a nuclear installation}</p> <p>1/165 . . . {using heat pipes (heat pipes per se F28D 15/02)}</p> <p>1/167 . . . {using an organic fluid}</p> <p>1/18 . . the heat carrier being a hot gas, e.g. waste gas such as exhaust gas of internal-combustion engines (use of waste heat of combustion engines, in general, F02G)</p> <p>1/1807 . . . {using the exhaust gases of combustion engines}</p> <p>1/1815 {using the exhaust gases of gas-turbines}</p> <p>1/1823 . . . {for gas-cooled nuclear reactors}</p> <p>1/183 . . . {in combination with metallurgical converter installations}</p> <p>1/1838 . . . {the hot gas being under a high pressure, e.g. in chemical installations}</p> <p>1/1846 {the hot gas being loaded with particles, e.g. waste heat boilers after a coal gasification plant}</p> |
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| 1/1853 | . . . {coming in direct contact with water in bulk or in sprays} | 5/04 | . Component parts thereof; Accessories therefor (covers or similar closure members F16J 13/00) |
| 1/1861 | . . . {Waste heat boilers with supplementary firing} | 7/00 | Steam boilers of furnace-tube type, i.e. the combustion of fuel being performed inside one or more furnace tubes built-in in the boiler body |
| 1/1869 | . . . {Hot gas water tube boilers not provided for in F22B 1/1807 - F22B 1/1861 } | 7/02 | . without auxiliary water tubes |
| 1/1876 | {the hot gas being loaded with particles, e.g. dust (with the hot gas being under high pressure F22B 1/1846)} | 7/04 | . with auxiliary water tubes |
| 1/1884 | . . . {Hot gas heating tube boilers with one or more heating tubes} | 7/06 | . . inside the furnace tube in transverse arrangements |
| 1/1892 | . . . {Systems therefor not provided for in F22B 1/1807 - F22B 1/1861 } | 7/08 | . . inside the furnace tube in longitudinal arrangement |
| 1/20 | . using heat evolved in a solution absorbing steam; Soda steam boilers | 7/10 | . . outside the boiler body |
| 1/22 | . using combustion under pressure substantially exceeding atmospheric pressure | 7/12 | . with auxiliary fire tubes; Arrangement of header boxes providing for return diversion of flue gas flow |
| 1/24 | . . Pressure-fired steam boilers, e.g. using turbo-air compressors actuated by hot gases from boiler furnace | 7/14 | . with both auxiliary water tubes and auxiliary fire tubes |
| 1/26 | . . Steam boilers of submerged-flame type, i.e. the flame being surrounded by, or impinging on, the water to be vaporised {, e.g. water in sprays} | 7/16 | . Component parts thereof; Accessories therefor, e.g. stay-bolt connections |
| 1/265 | . . . {the water being in bulk} | 7/18 | . . Walling of flues; Flue gas header boxes |
| 1/28 | . in boilers heated electrically {(superheating using an electrical heat source independent from heat supply of the steam boiler F22G 1/165)} | 7/20 | . . Furnace tubes |
| 1/281 | . . {other than by electrical resistances or electrodes} | 9/00 | Steam boilers of fire-tube type, i.e. the flue gas from a combustion chamber outside the boiler body flowing through tubes built-in in the boiler body |
| 1/282 | . . {with water or steam circulating in tubes or ducts} | 9/02 | . the boiler body being disposed upright, e.g. above the combustion chamber |
| 1/284 | . . {with water in reservoirs} | 9/04 | . . the fire tubes being in upright arrangement |
| 1/285 | . . . {the water being fed by a pump to the reservoirs} | 9/06 | . . . Arrangement of header boxes providing for return diversion of flue gas flow |
| 1/287 | . . {with water in sprays or in films} | 9/08 | . . the fire tubes being in horizontal arrangement |
| 1/288 | . . {Instantaneous electrical steam generators built-up from heat-exchange elements arranged within a confined chamber having heat-retaining walls} | 9/10 | . the boiler body being disposed substantially horizontally, e.g. at the side of the combustion chamber |
| 1/30 | . . Electrode boilers | 9/12 | . . the fire tubes being in substantially horizontal arrangement |
| 1/303 | . . . {with means for injecting or spraying water against electrodes or with means for water circulation} | 9/14 | . . . Arrangement of header boxes providing for return diversion of flue gas flow |
| 1/306 | {with at least one electrode permanently above the water surface} | 9/16 | . the boiler body containing fire tubes disposed crosswise in inclined upward arrangement |
| 3/00 | Other methods of steam generation; Steam boilers not provided for in other groups of this subclass | 9/18 | . Component parts thereof; Accessories therefor, e.g. stay-bolt connections |
| 3/02 | . involving the use of working media other than water | 11/00 | Steam boilers of combined fire-tube type and water-tube type, i.e. steam boilers of fire-tube type having auxiliary water tubes |
| 3/04 | . by drop in pressure of high-pressure hot water within pressure- reducing chambers, e.g. in accumulators (steam accumulators per se F01K 1/00) | 11/02 | . the fire tubes being in upright arrangement |
| 3/045 | . . {the drop in pressure being achieved by compressors, e.g. with steam jet pumps} | 11/04 | . the fire tubes being in horizontal arrangement |
| 3/06 | . by transformation of mechanical, e.g. kinetic, energy into heat energy | 13/00 | Steam boilers of fire-box type, i.e. the combustion of fuel being performed in a chamber or fire-box with subsequent flue(s) or fire tube(s), both chamber or fire-box and flues or fire tubes being built-in in the boiler body |
| 3/08 | . at critical or supercritical pressure values | 13/005 | . {with flues, other than fire tubes} |
| Kinds of steam boilers | | 13/02 | . mounted in fixed position with the boiler body disposed upright |
| 5/00 | Steam boilers of drum type, i.e. without internal furnace or fire tubes, the boiler body being contacted externally by flue gas | 13/023 | . . {with auxiliary water tubes inside the fire-box, e.g. vertical tubes (F22B 13/10 takes precedence)} |
| 5/005 | . {with rotating drums} | 13/026 | . . . {the tubes being in substantially horizontal arrangement} |
| 5/02 | . with auxiliary water tubes outside the boiler body | 13/04 | . mounted in fixed position with the boiler body disposed substantially horizontally |
| | | 13/06 | . Locomobile, traction-engine, steam-roller, or locomotive boilers |

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| 13/065 | . . {Combination of low and high pressure locomotive boilers} | 21/085 | {the tubes being placed in layers} |
| 13/08 | . . without auxiliary water tubes inside the fire-box | 21/086 | {Frames built-up from water tubes} |
| 13/10 | . . with auxiliary water tubes inside the fire-box | 21/088 | {involving an upper drum and a lower drum and two lateral drums} |
| 13/12 | . . . the auxiliary water tubes lining the fire-box | 21/10 | . . . the water tubes being arranged in staggered rows |
| 13/14 | . Component parts thereof; Accessories therefor | 21/12 | . . involving two or more upper drums and two or more lower drums, e.g. with crosswise-arranged water-tube sets in abutting connections with drums |
| 13/145 | . . {Firebox thermosiphons} | 21/123 | . . . {involving crossed water tubes} |
| 13/16 | . . Stay-bolt connections, e.g. rigid connections | 21/126 | . . . {involving more than two lower or upper drums} |
| 13/18 | . . . Flexible connections, e.g. of ball-and-socket type | 21/14 | . . involving a single upper drum and two or more lower drums |
| 15/00 | Water-tube boilers of horizontal type, i.e. the water-tube sets being arranged horizontally | 21/16 | . . . the lower drums being interconnected by further water tubes |
| 17/00 | Water-tube boilers of horizontally-inclined type, e.g. the water-tube sets being inclined slightly with respect to the horizontal plane | 21/18 | . . involving two or more upper drums and a single lower drum |
| 17/02 | . built-up from water-tube sets in abutting connection with two header boxes in common for all sets, e.g. with flat header boxes | 21/185 | . . . {involving more than two upper drums and a single lower drum} |
| 17/025 | . . {with combined inlet and outlet header boxes, e.g. connected by U-tubes or Field tubes} | 21/20 | . . involving sectional or subdivided headers in separate arrangement for each water-tube set |
| 17/04 | . . the water-tube sets being inclined in opposite directions, e.g. crosswise | 21/22 | . built-up from water tubes of form other than straight or substantially straight |
| 17/06 | . . the water-tube sets being bent angularly | 21/24 | . . bent in serpentine or sinuous form |
| 17/08 | . . the water-tube sets being curved | 21/26 | . . bent helically, i.e. coiled |
| 17/10 | . built-up from water-tube sets in abutting connection with two sectional headers each for every set, i.e. with headers in a number of sections across the width or height of the boiler | 21/28 | . . bent spirally |
| 17/105 | . . {with tubes in series flow arrangement} | 21/30 | . . bent in U-loop form |
| 17/12 | . . the sectional headers being in vertical or substantially vertical arrangement | 21/32 | . . . disposed horizontally in abutting connection with upright headers or rising water mains |
| 17/14 | . . the sectional headers being in horizontal or substantially horizontal arrangement | 21/34 | . built-up from water tubes grouped in panel form surrounding the combustion chamber, i.e. radiation boilers |
| 17/16 | . Component parts thereof; Accessories therefor | 21/341 | . . {Vertical radiation boilers with combustion in the lower part} |
| 17/18 | . . Header boxes; Sectional headers | 21/343 | . . . {the vertical radiation combustion chamber being connected at its upper part to a sideways convection chamber} |
| 19/00 | Water-tube boilers of combined horizontally-inclined type and vertical type, i.e. water-tube boilers of horizontally-inclined type having auxiliary water-tube sets in vertical or substantially vertical arrangement | 21/345 | {with a tube bundle between an upper and a lower drum in the convection pass} |
| 21/00 | Water-tube boilers of vertical or steeply-inclined type, i.e. the water-tube sets being arranged vertically or substantially vertically | 21/346 | . . {Horizontal radiation boilers} |
| 21/002 | . {involving a single upper drum (F22B 21/36 takes precedence)} | 21/348 | . . {Radiation boilers with a burner at the top} |
| 21/005 | . {involving a central vertical drum, header or downcomer} | 21/36 | . . involving an upper drum or headers mounted at the top of the combustion chamber |
| 21/007 | . {specially adapted for locomotives} | 21/363 | . . . {involving a horizontal drum mounted in an upper corner of the boiler} |
| 21/02 | . built-up from substantially straight water tubes | 21/366 | . . . {involving a horizontal drum mounted in the middle of the boiler} |
| 21/04 | . . involving a single upper drum and a single lower drum, e.g. the drums being arranged transversely | 21/38 | . . Component parts thereof, e.g. prefabricated panels |
| 21/06 | . . . the water tubes being arranged annularly in sets, e.g. in abutting connection with drums of annular shape | 21/40 | . built-up from water tubes arranged in a comparatively long vertical shaft, i.e. tower boilers |
| 21/065 | {involving an upper and lower drum of annular shape} | 23/00 | Water-tube boilers built-up from sets of spaced double-walled water tubes of return type in unilateral abutting connection with a boiler drum or with a header box, i.e. built-up from Field water tubes comprising an inner tube arranged within an outer unilaterally-closed tube |
| 21/08 | . . . the water tubes being arranged sectionally in groups or in banks, e.g. bent over at their ends | 23/02 | . the water-tube, i.e. Field-tube, sets being horizontal or substantially horizontal |
| 21/081 | {involving a combustion chamber, placed at the side and built-up from water tubes} | 23/04 | . the water-tube, i.e. Field-tube, sets being vertical or substantially vertical |
| 21/083 | {involving an upper drum and a lower drum and a fire-place between the two drums} | | |

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| 23/06 | <ul style="list-style-type: none"> Component parts thereof, e.g. Field water tubes (heat-exchange tubes in general F28F) | 29/12 | <ul style="list-style-type: none"> operating with superimposed recirculation during starting and low-load periods, e.g. composite boilers |
| 25/00 | Water-tube boilers built-up from sets of water tubes with internally-arranged flue tubes, or fire tubes, extending through the water tubes | 31/00 | Modifications of boiler construction, or of tube systems, dependent on installation of combustion apparatus; Arrangements of dispositions of combustion apparatus (steam generation characterised by heating method F22B 1/00; combustion apparatus per se F23) |
| 27/00 | Instantaneous or flash steam boilers | | |
| 27/02 | <ul style="list-style-type: none"> built-up from fire tubes | 31/0007 | <ul style="list-style-type: none"> {with combustion in a fluidized bed (fluidized bed apparatus per se B01J 8/00; fluidized bed combustors F23C 10/00)} |
| 27/04 | <ul style="list-style-type: none"> built-up from water tubes (F22B 27/12 - F22B 27/16 take precedence) | 31/0015 | <ul style="list-style-type: none"> {for boilers of the water tube type} |
| 27/06 | <ul style="list-style-type: none"> bent in serpentine or sinuous form | 31/0023 | <ul style="list-style-type: none"> {with tubes in the bed (F22B 31/003 takes precedence)} |
| 27/08 | <ul style="list-style-type: none"> bent helically, i.e. coiled | 31/003 | <ul style="list-style-type: none"> {with tubes surrounding the bed or with water tube wall partitions} |
| 27/10 | <ul style="list-style-type: none"> bent spirally | 31/0038 | <ul style="list-style-type: none"> {with tubes in the bed} |
| 27/12 | <ul style="list-style-type: none"> built-up from rotary heat-exchange elements, e.g. from tube assemblies | 31/0046 | <ul style="list-style-type: none"> {for boilers of the shell type, e.g. with furnace box} |
| 27/14 | <ul style="list-style-type: none"> built-up from heat-exchange elements arranged within a confined chamber having heat-retaining walls (F22B 1/288 takes precedence) | 31/0053 | <ul style="list-style-type: none"> {with auxiliary water tubes} |
| 27/16 | <ul style="list-style-type: none"> involving spray nozzles for sprinkling or injecting water particles on to or into hot heat-exchange elements, e.g. into tubes (F22B 1/287 takes precedence) | 31/0061 | <ul style="list-style-type: none"> {Constructional features of bed cooling} |
| 27/165 | <ul style="list-style-type: none"> {with film flow of water on heated surfaces} | 31/0069 | <ul style="list-style-type: none"> {Systems therefor} |
| 29/00 | Steam boilers of forced-flow type | 31/0076 | <ul style="list-style-type: none"> {Controlling processes for fluidized bed boilers not related to a particular type} |
| 29/02 | <ul style="list-style-type: none"> of forced-circulation type (F22B 29/06 takes precedence) | 31/0084 | <ul style="list-style-type: none"> {with recirculation of separated solids or with cooling of the bed particles outside the combustion bed} |
| 29/023 | <ul style="list-style-type: none"> {without drums, i.e. without hot water storage in the boiler} | 31/0092 | <ul style="list-style-type: none"> {with a fluidized heat exchange bed and a fluidized combustion bed separated by a partition, the bed particles circulating around or through that partition} |
| 29/026 | <ul style="list-style-type: none"> {operating at critical or supercritical pressure} | 31/02 | <ul style="list-style-type: none"> Installation of water-tube boilers in chimneys, e.g. in converter chimneys |
| 29/04 | <ul style="list-style-type: none"> of combined-circulation type, i.e. in which convection circulation due to the difference in specific gravity between cold and hot water is promoted by additional measures, e.g. by injecting pressure-water temporarily | 31/04 | <ul style="list-style-type: none"> Heat supply by installation of two or more combustion apparatus, e.g. of separate combustion apparatus for the boiler and the superheater respectively |
| 29/06 | <ul style="list-style-type: none"> of once-through type, i.e. built-up from tubes receiving water at one end and delivering superheated steam at the other end of the tubes (F22B 33/00 takes precedence) | 31/045 | <ul style="list-style-type: none"> {Steam generators specially adapted for burning refuse} |
| 29/061 | <ul style="list-style-type: none"> {Construction of tube walls} | 31/06 | <ul style="list-style-type: none"> Installation of emergency heat supply |
| 29/062 | <ul style="list-style-type: none"> {involving vertically-disposed water tubes} | 31/08 | <ul style="list-style-type: none"> Installation of heat-exchange apparatus or of means in boilers for heating air supplied for combustion |
| 29/064 | <ul style="list-style-type: none"> {involving horizontally- or helically-disposed water tubes} | | |
| 29/065 | <ul style="list-style-type: none"> {involving upper vertically disposed water tubes and lower horizontally- or helically disposed water tubes} | | |
| 29/067 | <ul style="list-style-type: none"> {operating at critical or supercritical pressure (with recirculation during normal operation F22B 29/026)} | | |
| 29/068 | <ul style="list-style-type: none"> {operating with superimposed recirculation during normal operation (F22B 29/12 takes precedence)} | | |
| 29/08 | <ul style="list-style-type: none"> operating with fixed point of final state of complete evaporation {(evaporation or evaporation apparatus for physical or chemical purposes, e.g. evaporation of liquids for gas phase reactions B01B 1/005)} | | |
| 29/10 | <ul style="list-style-type: none"> operating with sliding point of final state of complete evaporation {(evaporation or evaporation apparatus for physical or chemical purposes, e.g. evaporation of liquids for gas phase reactions B01B 1/005)} | | |

Steam-generation plants; Control systems

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| 33/00 | Steam-generation plants, e.g. comprising steam boilers of different types in mutual association (arrangements or dispositions of steam-generation plants in marine vessels B63H 21/00) |
| 33/02 | <ul style="list-style-type: none"> Combinations of boilers having a single combustion apparatus in common |
| 33/04 | <ul style="list-style-type: none"> of boilers of furnace-tube type with boilers of water-tube type |
| 33/06 | <ul style="list-style-type: none"> of boilers of furnace-tube type with boilers of fire-tube type |
| 33/08 | <ul style="list-style-type: none"> of boilers of water tube type with boilers of fire-tube type |
| 33/10 | <ul style="list-style-type: none"> of two or more superposed boilers with separate water volumes and operating with two or more separate water levels |
| 33/12 | <ul style="list-style-type: none"> Self-contained steam boilers, i.e. comprising as a unit the steam boiler, the combustion apparatus, the fuel storage, accessory machines and equipment |

- 33/14 . Combinations of low and high pressure boilers
([F22B 13/065](#) takes precedence)
- 33/16 . . of forced-flow type
- 33/18 . Combinations of steam boilers with other apparatus
- 33/185 . . {in combination with a steam accumulator}
- 35/00 Control systems for steam boilers** ({for fluidized bed boilers [F22B 31/0076](#); } regulation or control of steam power plants [F01K 7/00](#); for regulating feed-water supply [F22D](#); for controlling superheat temperature [F22G 5/00](#); control of combustion [F23N](#); regulating or controlling in general [G05](#))
- 35/001 . {Controlling by flue gas dampers (for superheaters [F22G 5/04](#))}
- 35/002 . {Control by recirculating flue gases (for superheaters [F22G 5/06](#))}
- 35/004 . {Control systems for steam generators of nuclear power plants}
- 35/005 . {Control systems for instantaneous steam boilers}
- 35/007 . {Control systems for waste heat boilers}
- 35/008 . {Control systems for two or more steam generators ([F22D 5/36](#) takes precedence)}
- 35/02 . for steam boilers with natural convection circulation
- 35/04 . . during starting-up periods, i.e. during the periods between the lighting of the furnaces and the attainment of the normal operating temperature of the steam boilers
- 35/06 . for steam boilers of forced-flow type
- 35/08 . . of forced-circulation type
- 35/083 . . . {without drum, i.e. without hot water storage in the boiler}
- 35/086 {operating at critical or supercritical pressure}
- 35/10 . . of once-through type
- 35/101 . . . {operating with superimposed recirculation during starting or low load periods, e.g. composite boilers ([F22B 35/125](#) takes precedence)}
- 35/102 . . . {operating with fixed point of final state of complete evaporation, e.g. in a steam-water separator}
- 35/104 . . . {Control systems by injecting water (for superheaters [F22G 5/12](#))}
- 35/105 . . . {operating at sliding pressure}
- 35/107 . . . {Control systems with auxiliary heating surfaces}
- 35/108 . . . {Control systems for steam generators having multiple flow paths}
- 35/12 . . . operating at critical or supercritical pressure
- 35/125 {operating with superimposed recirculation during starting or low load periods, e.g. composite boilers}
- 35/14 . . during the starting-up periods, i.e. during the periods between the lighting of the furnaces and the attainment of the normal operating temperature of the steam boilers
- 35/16 . . responsive to the percentage of steam in the mixture of steam and water
- 35/18 . Applications of computers to steam boiler control
- 37/00 Component parts or details of steam boilers** (venting devices [F16K 24/00](#); steam traps or like apparatus [F16T](#))
- 37/001 . {Steam generators built-up from pre-fabricated elements}
- 37/002 . {specially adapted for nuclear steam generators, e.g. maintenance, repairing or inspecting equipment not otherwise provided for}
- 37/003 . . {Maintenance, repairing or inspecting equipment positioned in or via the headers}
- 37/005 . . . {Positioning apparatus specially adapted therefor ([F22B 37/64](#) takes precedence)}
- 37/006 . . {Walking equipment, e.g. walking platforms suspended at the tube sheet ([walking mechanism per se B62D 57/02](#))}
- 37/007 . . {Installation or removal of nuclear steam generators}
- 37/008 . {Adaptations for flue gas purification in steam generators, (flue gas purification in general [F23J](#); gas purification in general [B01D](#))}
- 37/02 . applicable to more than one kind or type of steam boiler
- 37/025 . . {Devices and methods for diminishing corrosion, e.g. by preventing cooling beneath the dew point}
- 37/04 . . and characterised by material, e.g. use of special steel alloy
- 37/06 . . Flue or fire tubes; Accessories therefor, e.g. fire-tube inserts
- 37/08 . . . Fittings preventing burning-off of the tube edges
- 37/10 . . Water tubes; Accessories therefor ([working of metal tubes B21D](#); pipes in general [F16L](#); repairing leaks in water tubes [F16L 55/16](#); [F28F 11/00](#); baffles, screens, or deflectors formed of water tubes [F23M 9/10](#); cleaning internal or external surfaces of water tubes [F28G](#))
- 37/101 {Tubes having fins or ribs}
- 37/102 {Walls built-up from finned tubes}
- 37/103 {Internally ribbed tubes}
- 37/104 . . . {Connection of tubes one with the other or with collectors, drums or distributors (in general [F16L](#))}
- 37/105 . . . {Penetrations of tubes through a wall and their sealing (in general [F16L 5/00](#))}
- 37/106 . . . {Studding of tubes}
- 37/107 . . . {Protection of water tubes (in general [F16L 57/00](#))}
- 37/108 {Protection of water tube walls}
- 37/12 . . . Forms of water tubes, e.g. of varying cross-section
- 37/125 {Bifurcates}
- 37/14 . . . Supply mains, e.g. rising mains, down-comers, in connection with water tubes
- 37/141 {involving vertically-disposed water tubes, e.g. walls built-up from vertical tubes}
- 37/142 {involving horizontally-or helically-disposed water tubes, e.g. walls built-up from horizontal or helical tubes}
- 37/143 {Panel shaped heating surfaces built up from tubes ([F22B 37/145](#) takes precedence)}
- 37/145 {Flag-shaped panels built-up from tubes, e.g. from U-shaped tubes}
- 37/146 {Tube arrangements for ash hoppers and grates and for combustion chambers of the cyclone or similar type out of the flues}
- 37/147 {Tube arrangements for cooling orifices, doors and burners}
- 37/148 {Tube arrangements for the roofs}
- 37/16 . . . Return bends

- 37/165 {Closures for access openings in return bends (boiler plugs for drums or headers [F22B 37/223](#))}
- 37/18 . . . Inserts, e.g. for receiving deposits from water
- 37/20 . . . Supporting arrangements, e.g. for securing water-tube sets (construction of tube walls of furnaces including boiler furnaces [F23M 5/08](#))
- 37/201 {Suspension and securing arrangements for walls built-up from tubes}
- 37/202 {Suspension and securing arrangements for contact heating surfaces}
- 37/203 {Horizontal tubes supported only away from their ends on vertical support tubes}
- 37/204 {Supporting arrangements for individual tubes, e.g. for securing tubes to a refractory wall}
- 37/205 {Supporting and spacing arrangements for tubes of a tube bundle}
- 37/206 {Anti-vibration supports for the bends of U-tube steam generators}
- 37/207 {Supporting arrangements for drums and collectors}
- 37/208 {Backstay arrangements}
- 37/22 . . Drums; Headers; Accessories therefor (making boilers from sheet metal [B21D 51/24](#); pressure vessels in general [F16J 12/00](#); covers or similar closure members [F16J 13/00](#))
- 37/221 . . . {Covers for drums, collectors, manholes or the like (in general [F16J 13/00](#))}
- 37/222 {Nozzle dams introduced through a smaller manway, e.g. foldable}
- 37/223 {Boiler plugs, e.g. for handholes (closures for access openings in return bends [F22B 37/165](#))}
- 37/225 . . . {Arrangements on drums or collectors for fixing tubes or for connecting collectors to each other}
- 37/226 . . . {Protection of drums against combustion}
- 37/227 . . . {Drums and collectors for mixing}
- 37/228 . . . {Headers for distributing feedwater into steam generator vessels; Accessories therefor}
- 37/24 . . Supporting, suspending, or setting arrangements, e.g. heat shielding (frames, engine beds [F16M](#))
- 37/242 . . . {for bottom supported water-tube steam generators}
- 37/244 . . . {for water-tube steam generators suspended from the top}
- 37/246 . . . {for steam generators of the reservoir type, e.g. nuclear steam generators}
- 37/248 {with a vertical cylindrical wall}
- 37/26 . . Steam-separating arrangements (vapour-liquid separators, e.g. for drying steam, [B01D](#); [B04](#))
- 37/261 . . . {specially adapted for boiler drums}
- 37/263 . . . {Valves with water separators}
- 37/265 . . . {Apparatus for washing and purifying steam}
- 37/266 . . . {Separator reheaters}
- 37/268 . . . {specially adapted for steam generators of nuclear power plants}
- 37/28 . . . involving reversal of direction of flow
- 37/283 {specially adapted for boiler drums}
- 37/286 {specially adapted for steam generators of nuclear power plants}
- 37/30 . . . using impingement against baffle separators
- 37/303 {specially adapted for boiler drums}
- 37/306 {specially adapted for steam generators of nuclear power plants}
- 37/32 . . . using centrifugal force
- 37/322 {specially adapted for boiler drums}
- 37/325 {using a revolving element}
- 37/327 {specially adapted for steam generators of nuclear power plants}
- 37/34 . . Adaptations of boilers for promoting water circulation ([F22B 13/145](#) takes precedence); auxiliary devices for promoting water circulation [F22D 7/00](#))
- 37/36 . . Arrangements for sheathing or casing boilers
- 37/365 . . . {Casings of metal sheets, e.g. expansion plates, expansible joints}
- 37/38 . . Determining or indicating operating conditions in steam boilers, e.g. monitoring direction or rate of water flow through water tubes (measuring or indicating instruments in general [G01](#))
- 37/40 . . Arrangements of partition walls in flues of steam boilers, e.g. built-up from baffles (in flues or chimneys [F23J 13/00](#))
- 37/42 . . Applications, arrangements, or dispositions of alarm or automatic safety devices (for feed-water heaters [F22D 1/14](#) {; emergency feed-water supply [F22D 11/003](#)}; alarms responsive to undesired or abnormal conditions [G08B](#))
- 37/421 . . . {Arrangements for detecting leaks}
- 37/423 . . . {Valves for testing steam generators}
- 37/425 . . . {Feed-water supply alarm devices using floats}
- 37/426 . . . {Feed-water supply alarm devices using electric signals}
- 37/428 . . . {Feed-water supply alarm devices using dilatation of solids or liquids}
- 37/44 . . . of safety valves (safety valves per se [F16K](#))
- 37/443 {Safety devices extinguishing the fire}
- 37/446 {Safety devices responsive to overpressure}
- 37/46 . . . responsive to low or high water level, e.g. for checking, suppressing, extinguishing combustion in boilers (fire-fighting, fire extinction in general [A62](#))
- 37/47 . . . responsive to abnormal temperature, e.g. actuated by fusible plugs (such alarms or devices per se [G08B](#))
- 37/475 {Safety devices with fusible plugs}
- 37/48 . . Devices for removing water, salt, or sludge from boilers (cleaning internal or external surfaces of water tubes [F28G](#)); Arrangements of cleaning apparatus in boilers (cleaning external surfaces of tubes by soot blowers [F23J](#)); Combinations thereof with boilers
- 37/483 . . . {specially adapted for nuclear steam generators}
- 37/486 . . . {Devices for removing water, salt, or sludge from boilers ([F22B 37/483](#), [F22B 37/50](#), [F22B 37/52](#) and [F22B 37/54](#) take precedence)}
- 37/50 . . . for draining or expelling water
- 37/52 . . . Washing-out devices
- 37/54 . . . De-sludging or blow-down devices ([F22B 37/565](#) takes precedence)}
- 37/545 {Valves specially adapted therefor (valves in general [F16K](#))}
- 37/56 . . Boiler cleaning control devices, e.g. for ascertaining proper duration of boiler blow-down

- 37/565 . . . {Blow-down control, e.g. for ascertaining proper duration of boiler blow-down}
- 37/58 . . Removing tubes from headers or drums; Extracting tools
- 37/60 . specially adapted for steam boilers of instantaneous or flash type
- 37/62 . specially adapted for steam boilers of forced-flow type
- 37/64 . . Mounting of, or supporting arrangements for, tube units (construction of tube walls of furnaces, e.g. boiler furnaces [F23M 5/08](#))
- 37/645 . . . {involving upper vertically-disposed water tubes and lower horizontally- or helically disposed water tubes}
- 37/66 . . . involving vertically-disposed water tubes ([F22B 37/645 takes precedence](#))
- 37/68 . . . involving horizontally-disposed water tubes ([F22B 37/645 takes precedence](#))
- 37/70 . . Arrangements for distributing water into water tubes
- 37/72 . . . involving injection devices
- 37/74 . . . Throttling arrangements for tubes or sets of tubes
- 37/76 . Adaptations or mounting of devices for observing existence or direction of fluid flow (devices [per se G01P](#))
- 37/78 . Adaptations or mounting of level indicators (level indicators [per se G01F](#))