

# 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.

<b>General aspects of, or methods for, steam generation</b>	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 <a href="#">F28D 7/10</a> ; double-wall pipes <a href="#">per se F16L 9/18</a> )}
<b>1/00 Methods of steam generation characterised by form of heating method (solar heating <a href="#">F24S</a>; jackets or other cooling means in which steam is generated and which serve for cooling other apparatus, see the subclasses for such apparatus)</b>	1/08	. . the heat carrier being steam
<b>1/003 . {using combustion of hydrogen with oxygen (power plants using steam created by combustion of hydrogen with oxygen <a href="#">F01K 25/005</a>)}</b>	1/10	. . . released from heat accumulators
<b>1/006 . {using solar heat (solar heat collectors <a href="#">per se F24S</a>; devices for producing mechanical power from solar energy <a href="#">F03G 6/00</a>)}</b>	1/12	. . . produced by an indirect cyclic process
<b>1/02 . by exploitation of the heat content of hot heat carriers</b>	1/123	. . . . {Steam generators downstream of a nuclear boiling water reactor}
<b>1/021 . . {with heating tubes in which flows a non-specified heating fluid (for nuclear reactors <a href="#">F22B 1/023</a>, for hot gas <a href="#">F22B 1/1884</a>)}</b>	1/126	. . . . {Steam generators of the Schmidt-Hartmann type}
<b>1/023 . . {with heating tubes, for nuclear reactors as far as they are not classified, according to a specified heating fluid, in another group}</b>	1/14	. . . coming in direct contact with water in bulk or in sprays
<b>1/025 . . . {with vertical U shaped tubes carried on a horizontal tube sheet}</b>	1/143	. . . . {in combination with a nuclear installation}
<b>1/026 . . . {with vertical tubes between to horizontal tube sheets}</b>	1/146	. . . . {Loffler boilers}
<b>1/028 . . {Steam generation using heat accumulators (<a href="#">F22B 27/14</a> takes precedence)}</b>	1/16	. . the heat carrier being hot liquid or hot vapour, e.g. waste liquid, waste vapour
<b>1/04 . . the heat carrier being hot slag, hot residues, or heated blocks, e.g. iron blocks</b>	1/162	. . . {in combination with a nuclear installation}
<b>1/06 . . the heat carrier being molten; Use of molten metal, e.g. zinc, as heat transfer medium</b>	1/165	. . . {using heat pipes ( <a href="#">heat pipes per se F28D 15/02</a> )}
<b>1/063 . . . {for metal cooled nuclear reactors (heat-exchangers having a liquid metal as heat exchange medium <a href="#">F28D7/00C</a>)}</b>	1/167	. . . {using an organic fluid}
	1/18	. . the heat carrier being a hot gas, e.g. waste gas such as exhaust gas of internal-combustion engines ( <a href="#">use of waste heat of combustion engines, in general, F02G</a> )
	1/1807	. . . {using the exhaust gases of combustion engines}
	1/1815	. . . . {using the exhaust gases of gas-turbines}
	1/1823	. . . {for gas-cooled nuclear reactors}
	1/183	. . . {in combination with metallurgical converter installations}
	1/1838	. . . {the hot gas being under a high pressure, e.g. in chemical installations}
	1/1846	. . . . {the hot gas being loaded with particles, e.g. waste heat boilers after a coal gasification plant}

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 <a href="#">F16J 13/00</a> )
1/1861	. . . {Waste heat boilers with supplementary firing}	<b>7/00</b>	<b>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</b>
1/1869	. . . {Hot gas water tube boilers not provided for in <a href="#">F22B 1/1807</a> - <a href="#">F22B 1/1861</a> }	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 <a href="#">F22B 1/1846</a> )}	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 <a href="#">F22B 1/1807</a> - <a href="#">F22B 1/1861</a> }	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 <a href="#">F22G 1/165</a> )}	7/20	. . Furnace tubes
1/281	. . {other than by electrical resistances or electrodes}	<b>9/00</b>	<b>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</b>
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
<b>3/00</b>	<b>Other methods of steam generation; Steam boilers not provided for in other groups of this subclass</b>	9/18	. Component parts thereof; Accessories therefor, e.g. stay-bolt connections
3/02	. involving the use of working media other than water	<b>11/00</b>	<b>Steam boilers of combined fire-tube type and water-tube type, i.e. steam boilers of fire-tube type having auxiliary water tubes</b>
3/04	. by drop in pressure of high-pressure hot water within pressure- reducing chambers, e.g. in accumulators (steam accumulators <a href="#">per se</a> <a href="#">F01K 1/00</a> )	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	<b>13/00</b>	<b>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</b>
3/08	. at critical or supercritical pressure values	13/005	. {with flues, other than fire tubes}
<b>Kinds of steam boilers</b>		13/02	. mounted in fixed position with the boiler body disposed upright
<b>5/00</b>	<b>Steam boilers of drum type, i.e. without internal furnace or fire tubes, the boiler body being contacted externally by flue gas</b>	13/023	. . {with auxiliary water tubes inside the fire-box, e.g. vertical tubes ( <a href="#">F22B 13/10</a> 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

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
<b>15/00</b>	<b>Water-tube boilers of horizontal type, i.e. the water-tube sets being arranged horizontally</b>	21/16	. . . the lower drums being interconnected by further water tubes
<b>17/00</b>	<b>Water-tube boilers of horizontally-inclined type, e.g. the water-tube sets being inclined slightly with respect to the horizontal plane</b>	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}
<b>19/00</b>	<b>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</b>	21/345	. . . . {with a tube bundle between an upper and a lower drum in the convection pass}
<b>21/00</b>	<b>Water-tube boilers of vertical or steeply-inclined type, i.e. the water-tube sets being arranged vertically or substantially vertically</b>	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}	<b>23/00</b>	<b>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</b>
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}		

- 23/06 . Component parts thereof, e.g. Field water tubes  
([heat-exchange tubes in general F28F](#))
- 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**
- 27/00 Instantaneous or flash steam boilers**
- 27/02 . built-up from fire tubes
- 27/04 . built-up from water tubes  
([F22B 27/12 - F22B 27/16 take precedence](#))
- 27/06 . . bent in serpentine or sinuous form
- 27/08 . . bent helically, i.e. coiled
- 27/10 . . bent spirally
- 27/12 . built-up from rotary heat-exchange elements, e.g. from tube assemblies
- 27/14 . built-up from heat-exchange elements arranged within a confined chamber having heat-retaining walls {([F22B 1/288 takes precedence](#))}
- 27/16 . 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](#))}
- 27/165 . . {with film flow of water on heated surfaces}
- 29/00 Steam boilers of forced-flow type**
- 29/02 . of forced-circulation type {([F22B 29/06 takes precedence](#))}
- 29/023 . . {without drums, i.e. without hot water storage in the boiler}
- 29/026 . . . {operating at critical or supercritical pressure}
- 29/04 . 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
- 29/06 . 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](#))
- 29/061 . . {Construction of tube walls}
- 29/062 . . . {involving vertically-disposed water tubes}
- 29/064 . . . {involving horizontally- or helically-disposed water tubes}
- 29/065 . . . {involving upper vertically disposed water tubes and lower horizontally- or helically disposed water tubes}
- 29/067 . . {operating at critical or supercritical pressure (with recirculation during normal operation [F22B 29/026](#))}
- 29/068 . . {operating with superimposed recirculation during normal operation ([F22B 29/12 takes precedence](#))}
- 29/08 . . 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 . . 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](#))}
- 29/12 . . operating with superimposed recirculation during starting and low-load periods, e.g. composite boilers
- 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](#))**
- 31/0007 . {with combustion in a fluidized bed (fluidized bed apparatus per se [B01J 8/00](#); fluidized bed combustors [F23C 10/00](#))}
- 31/0015 . . {for boilers of the water tube type}
- 31/0023 . . . {with tubes in the bed ([F22B 31/003 takes precedence](#))}
- 31/003 . . . {with tubes surrounding the bed or with water tube wall partitions}
- 31/0038 . . . . {with tubes in the bed}
- 31/0046 . . {for boilers of the shell type, e.g. with furnace box}
- 31/0053 . . . {with auxiliary water tubes}
- 31/0061 . . {Constructional features of bed cooling}
- 31/0069 . . {Systems therefor}
- 31/0076 . . {Controlling processes for fluidized bed boilers not related to a particular type}
- 31/0084 . . {with recirculation of separated solids or with cooling of the bed particles outside the combustion bed}
- 31/0092 . . . {with a fluidized heat exchange bed and a fluidized combustion bed separated by a partition, the bed particles circulating around or through that partition}
- 31/02 . Installation of water-tube boilers in chimneys, e.g. in converter chimneys
- 31/04 . Heat supply by installation of two or more combustion apparatus, e.g. of separate combustion apparatus for the boiler and the superheater respectively
- 31/045 . . {Steam generators specially adapted for burning refuse}
- 31/06 . . Installation of emergency heat supply
- 31/08 . Installation of heat-exchange apparatus or of means in boilers for heating air supplied for combustion
- Steam-generation plants; Control systems**
- 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 . Combinations of boilers having a single combustion apparatus in common
- 33/04 . . of boilers of furnace-tube type with boilers of water-tube type
- 33/06 . . of boilers of furnace-tube type with boilers of fire-tube type
- 33/08 . . of boilers of water tube type with boilers of fire-tube type
- 33/10 . . of two or more superposed boilers with separate water volumes and operating with two or more separate water levels
- 33/12 . Self-contained steam boilers, i.e. comprising as a unit the steam boiler, the combustion apparatus, the fuel storage, accessory machines and equipment

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