

**CPC****COOPERATIVE PATENT CLASSIFICATION****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

**General aspects of, or methods for, steam generation**

- F22B 1/00**      **Methods of steam generation characterised by form of heating method** (solar heating [F24J](#); jackets or other cooling means in which steam is generated and which serve for cooling other apparatus, see the subclasses for such apparatus)
- [F22B 1/003](#)      . {using combustion of hydrogen with oxygen (power plants using steam created by combustion of hydrogen with oxygen [F01K 25/005](#))}
- [F22B 1/006](#)      . {using solar heat (solar heat collectors per se [F24J 2/00](#); devices for producing mechanical power from solar energy [F03G 6/00](#))}
- [F22B 1/02](#)      . by exploitation of the heat content of hot heat carriers
- [F22B 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](#))}
- [F22B 1/023](#)      .. {with heating tubes, for nuclear reactors as far as they are not classified, according to a specified heating fluid, in another group}
- [F22B 1/025](#)      ... {with vertical U shaped tubes carried on a horizontal tube sheet}
- [F22B 1/026](#)      ... {with vertical tubes between to horizontal tube sheets}
- [F22B 1/028](#)      .. {Steam generation using heat accumulators ([F22B 27/14](#) takes precedence)}
- [F22B 1/04](#)      .. the heat carrier being hot slag, hot residues, or heated blocks, e.g. iron blocks
- [F22B 1/06](#)      .. the heat carrier being molten; Use of molten metal, e.g. zinc, as heat transfer medium
- [F22B 1/063](#)      ... {for metal cooled nuclear reactors (heat-exchangers having a liquid metal as heat exchange medium [F28D7/00C](#))}
- [F22B 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](#))}
- [F22B 1/08](#)      .. the heat carrier being steam
- [F22B 1/10](#)      ... released from heat accumulators
- [F22B 1/12](#)      ... produced by an indirect cyclic process
- [F22B 1/123](#)      .... {Steam generators downstream of a nuclear boiling water reactor}
- [F22B 1/126](#)      .... {Steam generators of the Schmidt-Hartmann type}
- [F22B 1/14](#)      ... coming in direct contact with water in bulk or in sprays
- [F22B 1/143](#)      .... {in combination with a nuclear installation}

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| F22B 1/146  | .... | {Loffler boilers}  |
| F22B 1/16   | ..   | the heat carrier being hot liquid or hot vapour, e.g. waste liquid, waste vapour   |
| F22B 1/162  | ...  | {in combination with a nuclear installation}   |
| F22B 1/165  | ...  | {using heat pipes (heat pipes per se <a href="#">F28D 15/02</a> )}   |
| F22B 1/167  | ...  | {using an organic fluid}   |
| F22B 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, <a href="#">F02G</a> ) |
| F22B 1/1807 | ...  | {using the exhaust gases of combustion engines}  |
| F22B 1/1815 | .... | {using the exhaust gases of gas-turbines}  |
| F22B 1/1823 | ...  | {for gas-cooled nuclear reactors}  |
| F22B 1/183  | ...  | {in combination with metallurgical converter installations}  |
| F22B 1/1838 | ...  | {the hot gas being under a high pressure, e.g. in chemical installations}  |
| F22B 1/1846 | .... | {the hot gas being loaded with particles, e.g. waste heat boilers after a coal gasification plant}   |
| F22B 1/1853 | ...  | {coming in direct contact with water in bulk or in sprays}   |
| F22B 1/1861 | ...  | {Waste heat boilers with supplementary firing}   |
| F22B 1/1869 | ...  | {Hot gas water tube boilers not provided for in <a href="#">F22B 1/1807</a> - <a href="#">F22B 1/1861</a> }  |
| F22B 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> )}   |
| F22B 1/1884 | ...  | {Hot gas heating tube boilers with one or more heating tubes}  |
| F22B 1/1892 | ...  | {Systems therefor not provided for in <a href="#">F22B 1/1807</a> to <a href="#">F22B 1/1861</a> }   |
| F22B 1/20   | .    | using heat evolved in a solution absorbing steam; Soda steam boilers   |
| F22B 1/22   | .    | using combustion under pressure substantially exceeding atmospheric pressure   |
| F22B 1/24   | ..   | Pressure-fired steam boilers, e.g. using turbo-air compressors actuated by hot gases from boiler furnace   |
| F22B 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}                                     |
| F22B 1/265  | ...  | {the water being in bulk}  |
| F22B 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> )}                     |
| F22B 1/281  | ..   | {other than by electrical resistances or electrodes}   |
| F22B 1/282  | ..   | {with water or steam circulating in tubes or ducts}  |
| F22B 1/284  | ..   | {with water in reservoirs}   |
| F22B 1/285  | ...  | {the water being fed by a pump to the reservoirs}  |
| F22B 1/287  | ..   | {with water in sprays or in films}   |
| F22B 1/288  | ..   | {Instantaneous electrical steam generators built-up from heat-exchange elements arranged within a confined chamber having heat-retaining walls}                                  |
| F22B 1/30   | ..   | Electrode boilers  |
| F22B 1/303  | ...  | {with means for injecting or spraying water against electrodes or with means for water circulation}  |
| F22B 1/306  | .... | {with at least one electrode permanently above the water surface}  |

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| <b>F22B 3/00</b> | <b>Other methods of steam generation; Steam boilers not provided for in other groups of this subclass</b>   |
| F22B 3/02        | . involving the use of working media other than water   |
| F22B 3/04        | . by drop in pressure of high-pressure hot water within pressure- reducing chambers, e.g. in accumulators ( <a href="#">steam accumulators per se F01K 1/00</a> ) |
| F22B 3/045       | . . {the drop in pressure being achieved by compressors, e.g. with steam jet pumps}   |
| F22B 3/06        | . by transformation of mechanical, e.g. kinetic, energy into heat energy  |
| F22B 3/08        | . at critical or supercritical pressure values  |

### **Kinds of steam boilers**

|                  |   |
|------------------|---|
| <b>F22B 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>                        |
| F22B 5/005       | . {with rotating drums}   |
| F22B 5/02        | . with auxiliary water tubes outside the boiler body  |
| F22B 5/04        | . Component parts thereof; Accessories therefor ( <a href="#">covers or similar closure members F16J 13/00</a> )  |
| <b>F22B 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>           |
| F22B 7/02        | . without auxiliary water tubes   |
| F22B 7/04        | . with auxiliary water tubes  |
| F22B 7/06        | . . inside the furnace tube in transverse arrangements  |
| F22B 7/08        | . . inside the furnace tube in longitudinal arrangement   |
| F22B 7/10        | . . outside the boiler body   |
| F22B 7/12        | . with auxiliary fire tubes; Arrangement of header boxes providing for return diversion of flue gas flow  |
| F22B 7/14        | . with both auxiliary water tubes and auxiliary fire tubes  |
| F22B 7/16        | . Component parts thereof; Accessories therefor, e.g. stay-bolt connections   |
| F22B 7/18        | . . Walling of flues; Flue gas header boxes   |
| F22B 7/20        | . . Furnace tubes   |
| <b>F22B 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> |
| F22B 9/02        | . the boiler body being disposed upright, e.g. above the combustion chamber   |
| F22B 9/04        | . . the fire tubes being in upright arrangement   |
| F22B 9/06        | . . . Arrangement of header boxes providing for return diversion of flue gas flow   |
| F22B 9/08        | . . the fire tubes being in horizontal arrangement  |
| F22B 9/10        | . the boiler body being disposed substantially horizontally, e.g. at the side of the combustion chamber   |
| F22B 9/12        | . . the fire tubes being in substantially horizontal arrangement  |
| F22B 9/14        | . . . Arrangement of header boxes providing for return diversion of flue gas flow   |

- F22B 9/16
  - . the boiler body containing fire tubes disposed crosswise in inclined upward arrangement
- F22B 9/18
  - . Component parts thereof; Accessories therefor, e.g. stay-bolt connections
- F22B 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**
- F22B 11/02
  - . the fire tubes being in upright arrangement
- F22B 11/04
  - . the fire tubes being in horizontal arrangement
- F22B 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**
- F22B 13/005
  - . {with flues, other than fire tubes}
- F22B 13/02
  - . mounted in fixed position with the boiler body disposed upright
- F22B 13/023
  - .. {with auxiliary water tubes inside the fire-box, e.g. vertical tubes (F22B 13/10 takes precedence)}
- F22B 13/026
  - ... {the tubes being in substantially horizontal arrangement}
- F22B 13/04
  - . mounted in fixed position with the boiler body disposed substantially horizontally
- F22B 13/06
  - . Locomobile, traction-engine, steam-roller, or locomotive boilers
- F22B 13/065
  - .. {Combination of low and high pressure locomotive boilers}
- F22B 13/08
  - .. without auxiliary water tubes inside the fire-box
- F22B 13/10
  - .. with auxiliary water tubes inside the fire-box
- F22B 13/12
  - ... the auxiliary water tubes lining the fire-box
- F22B 13/14
  - . Component parts thereof; Accessories therefor
- F22B 13/145
  - .. {Firebox thermosiphons}
- F22B 13/16
  - .. Stay-bolt connections, e.g. rigid connections
- F22B 13/18
  - ... Flexible connections, e.g. of ball-and-socket type
- F22B 15/00**

**Water-tube boilers of horizontal type, i.e. the water-tube sets being arranged horizontally**
- F22B 17/00**

**Water-tube boilers of horizontally-inclined type, e.g. the water-tube sets being inclined slightly with respect to the horizontal plane**
- F22B 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
- F22B 17/025
  - .. {with combined inlet and outlet header boxes, e.g. connected by U-tubes or Field tubes}
- F22B 17/04
  - .. the water-tube sets being inclined in opposite directions, e.g. crosswise
- F22B 17/06
  - .. the water-tube sets being bent angularly
- F22B 17/08
  - .. the water-tube sets being curved
- F22B 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
- F22B 17/105
  - .. {with tubes in series flow arrangement}
- F22B 17/12
  - .. the sectional headers being in vertical or substantially vertical arrangement

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| F22B 17/14        | .. the sectional headers being in horizontal or substantially horizontal arrangement   |
| F22B 17/16        | . Component parts thereof; Accessories therefor  |
| F22B 17/18        | .. Header boxes; Sectional headers   |
| <b>F22B 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> |
| <b>F22B 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>   |
| F22B 21/002       | . {involving a single upper drum (F22B 21/36 takes precedence)}  |
| F22B 21/005       | . {involving a central vertical drum, header or downcomer}   |
| F22B 21/007       | . {specially adapted for locomotives}  |
| F22B 21/02        | . built-up from substantially straight water tubes   |
| F22B 21/04        | .. involving a single upper drum and a single lower drum, e.g. the drums being arranged transversely   |
| F22B 21/06        | ... the water tubes being arranged annularly in sets, e.g. in abutting connection with drums of annular shape  |
| F22B 21/065       | .... {involving an upper and lower drum of annular shape}  |
| F22B 21/08        | ... the water tubes being arranged sectionally in groups or in banks, e.g. bent over at their ends   |
| F22B 21/081       | .... {involving a combustion chamber, placed at the side and built-up from water tubes}  |
| F22B 21/083       | .... {involving an upper drum and a lower drum and a fire-place between the two drums}   |
| F22B 21/085       | .... {the tubes being placed in layers}  |
| F22B 21/086       | .... {Frames built-up from water tubes}  |
| F22B 21/088       | .... {involving an upper drum and a lower drum and two lateral drums}  |
| F22B 21/10        | ... the water tubes being arranged in staggered rows   |
| F22B 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  |
| F22B 21/123       | ... {involving crossed water tubes}  |
| F22B 21/126       | ... {involving more than two lower or upper drums}   |
| F22B 21/14        | .. involving a single upper drum and two or more lower drums   |
| F22B 21/16        | ... the lower drums being interconnected by further water tubes  |
| F22B 21/18        | .. involving two or more upper drums and a single lower drum   |
| F22B 21/185       | ... {involving more than two upper drums and a single lower drum}  |
| F22B 21/20        | .. involving sectional or subdivided headers in separate arrangement for each water-tube set   |
| F22B 21/22        | . built-up from water tubes of form other than straight or substantially straight  |
| F22B 21/24        | .. bent in serpentine or sinuous form  |
| F22B 21/26        | .. bent helically, i.e. coiled   |
| F22B 21/28        | .. bent spirally   |
| F22B 21/30        | .. bent in U-loop form   |

- F22B 21/32 . . . disposed horizontally in abutting connection with upright headers or rising water mains
- F22B 21/34 . built-up from water tubes grouped in panel form surrounding the combustion chamber, i.e. radiation boilers
- F22B 21/341 . . {Vertical radiation boilers with combustion in the lower part}
- F22B 21/343 . . . {the vertical radiation combustion chamber being connected at its upper part to a sideways convection chamber}
- F22B 21/345 . . . . {with a tube bundle between an upper and a lower drum in the convection pass}
- F22B 21/346 . . {Horizontal radiation boilers}
- F22B 21/348 . . {Radiation boilers with a burner at the top}
- F22B 21/36 . . involving an upper drum or headers mounted at the top of the combustion chamber
- F22B 21/363 . . . {involving a horizontal drum mounted in an upper corner of the boiler}
- F22B 21/366 . . . {involving a horizontal drum mounted in the middle of the boiler}
- F22B 21/38 . . Component parts thereof, e.g. prefabricated panels
- F22B 21/40 . built-up from water tubes arranged in a comparatively long vertical shaft, i.e. tower boilers

**F22B 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**

- F22B 23/02 . the water-tube, i.e. Field-tube, sets being horizontal or substantially horizontal
- F22B 23/04 . the water-tube, i.e. Field-tube, sets being vertical or substantially vertical
- F22B 23/06 . Component parts thereof, e.g. Field water tubes ([heat-exchange tubes in general F28F](#))

**F22B 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**

**F22B 27/00 Instantaneous or flash steam boilers**

- F22B 27/02 . built-up from fire tubes
- F22B 27/04 . built-up from water tubes ([F22B 27/12 to F22B 27/16 take precedence](#))
- F22B 27/06 . . bent in serpentine or sinuous form
- F22B 27/08 . . bent helically, i.e. coiled
- F22B 27/10 . . bent spirally
- F22B 27/12 . built-up from rotary heat-exchange elements, e.g. from tube assemblies
- F22B 27/14 . built-up from heat-exchange elements arranged within a confined chamber having heat-retaining walls ([F22B 1/288 takes precedence](#))
- F22B 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](#))
- F22B 27/165 . . {with film flow of water on heated surfaces}

**F22B 29/00 Steam boilers of forced-flow type**

- F22B 29/02 . of forced-circulation type ([F22B 29/06 takes precedence](#))

- F22B 29/023 . . {without drums, i.e. without hot water storage in the boiler}
- F22B 29/026 . . . {operating at critical or supercritical pressure}
- F22B 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
- F22B 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)
- F22B 29/061 . . {Construction of tube walls}
- F22B 29/062 . . . {involving vertically-disposed water tubes}
- F22B 29/064 . . . {involving horizontally- or helically-disposed water tubes}
- F22B 29/065 . . . {involving upper vertically disposed water tubes and lower horizontally- or helically disposed water tubes}
- F22B 29/067 . . {operating at critical or supercritical pressure (with recirculation during normal operation [F22B 29/026](#))}
- F22B 29/068 . . {operating with superimposed recirculation during normal operation ([F22B 29/12](#) takes precedence)}
- F22B 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](#))}
- F22B 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](#))}
- F22B 29/12 . . operating with superimposed recirculation during starting and low-load periods, e.g. composite boilers
- F22B 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](#))**
- F22B 31/0007 . {with combustion in a fluidized bed (fluidized bed apparatus per se [B01J 8/00](#); fluidized bed combustors [F23C 10/00](#))}
- F22B 31/0015 . . {for boilers of the water tube type}
- F22B 31/0023 . . . {with tubes in the bed ([F22B 31/003](#) takes precedence)}
- F22B 31/003 . . . {with tubes surrounding the bed or with water tube wall partitions}
- F22B 31/0038 . . . . {with tubes in the bed}
- F22B 31/0046 . . {for boilers of the shell type, e.g. with furnace box}
- F22B 31/0053 . . . {with auxiliary water tubes}
- F22B 31/0061 . . {Constructional features of bed cooling}
- F22B 31/0069 . . {Systems therefor}
- F22B 31/0076 . . {Controlling processes for fluidized bed boilers not related to a particular type}
- F22B 31/0084 . . {with recirculation of separated solids or with cooling of the bed particles outside the combustion bed}
- F22B 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}
- F22B 31/02 . Installation of water-tube boilers in chimneys, e.g. in converter chimneys



- F22B 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
- F22B 31/045 . . {Steam generators specially adapted for burning refuse}
- F22B 31/06 . . Installation of emergency heat supply
- F22B 31/08 . Installation of heat-exchange apparatus or of means in boilers for heating air supplied for combustion

### **Steam-generation plants; Control systems**

- F22B 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](#))
- F22B 33/02 . Combinations of boilers having a single combustion apparatus in common
- F22B 33/04 . . of boilers of furnace-tube type with boilers of water-tube type
- F22B 33/06 . . of boilers of furnace-tube type with boilers of fire-tube type
- F22B 33/08 . . of boilers of water tube type with boilers of fire-tube type
- F22B 33/10 . . of two or more superposed boilers with separate water volumes and operating with two or more separate water levels
- F22B 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
- F22B 33/14 . Combination of low and high pressure boilers ([F22B 13/065](#) takes precedence)
- F22B 33/16 . . of forced-flow type
- F22B 33/18 . Combinations of steam boilers with other apparatus
- F22B 33/185 . . {in combination with a steam accumulator}
- F22B 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](#))
- F22B 35/001 . {Controlling by flue gas dampers (for superheaters [F22G 5/04](#))}
- F22B 35/002 . {Control by recirculating flue gases (for superheaters [F22G 5/06](#))}
- F22B 35/004 . {Control systems for steam generators of nuclear power plants}
- F22B 35/005 . {Control systems for instantaneous steam boilers}
- F22B 35/007 . {Control systems for waste heat boilers}
- F22B 35/008 . {Control systems for two or more steam generators ([F22D 5/36](#) takes precedence)}
- F22B 35/02 . for steam boilers with natural convection circulation
- F22B 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
- F22B 35/06 . for steam boilers of forced-flow type
- F22B 35/08 . . of forced-circulation type
- F22B 35/083 . . . {without drum, i.e. without hot water storage in the boiler}
- F22B 35/086 . . . . {operating at critical or supercritical pressure}
- F22B 35/10 . . of once-through type



- F22B 35/101 . . . {operating with superimposed recirculation during starting or low load periods, e.g. composite boilers ([F22B 35/125](#) takes precedence)}
- F22B 35/102 . . . {operating with fixed point of final state of complete evaporation, e.g. in a steam-water separator}
- F22B 35/104 . . . {Control systems by injecting water (for superheaters [F22G 5/12](#))}
- F22B 35/105 . . . {operating at sliding pressure}
- F22B 35/107 . . . {Control systems with auxiliary heating surfaces}
- F22B 35/108 . . . {Control systems for steam generators having multiple flow paths}
- F22B 35/12 . . . operating at critical or supercritical pressure
- F22B 35/125 . . . . {operating with superimposed recirculation during starting or low load periods, e.g. composite boilers}
- F22B 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
- F22B 35/16 . . responsive to the percentage of steam in the mixture of steam and water
- F22B 35/18 . Application of computers to steam boiler control
  
- F22B 37/00** **Component parts or details of steam boilers** (venting devices [F16K 24/00](#); steam traps or like apparatus [F16T](#))
- F22B 37/001 . {Steam generators built-up from pre-fabricated elements}
- F22B 37/002 . {specially adapted for nuclear steam generators, e.g. maintenance, repairing or inspecting equipment not otherwise provided for}
- F22B 37/003 . . {Maintenance, repairing or inspecting equipment positioned in or via the headers}
- F22B 37/005 . . . {Positioning apparatus specially adapted therefor ([F22B 37/64](#) takes precedence)}
- F22B 37/006 . . {Walking equipment, e.g. walking platforms suspended at the tube sheet ([walking mechanism per se B62D 57/02](#))}
- F22B 37/007 . . {Installation or removal of nuclear steam generators}
- F22B 37/008 . {Adaptations for flue gas purification in steam generators, (flue gas purification in general [F23J](#); gas purification in general [B01D](#))}
- F22B 37/02 . applicable to more than one kind or type of steam boiler
- F22B 37/025 . . {Devices and methods for diminishing corrosion, e.g. by preventing cooling beneath the dew point}
- F22B 37/04 . . and characterised by material, e.g. use of special steel alloy
- F22B 37/06 . . Flue or fire tubes; Accessories therefor, e.g. fire-tube inserts
- F22B 37/08 . . . Fittings preventing burning-off of the tube edges
- F22B 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](#))
- F22B 37/101 . . . {Tubes having fins or ribs}
- F22B 37/102 . . . . {Walls built-up from finned tubes}
- F22B 37/103 . . . . {Internally ribbed tubes}
- F22B 37/104 . . . {Connection of tubes one with the other or with collectors, drums or distributors ([in general F16L](#))}

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| F22B 37/105 | ...   | {Penetrations of tubes through a wall and their sealing ( <a href="#">in general F16L 5/00</a> )}   |
| F22B 37/106 | ...   | {Studding of tubes}   |
| F22B 37/107 | ...   | {Protection of water tubes ( <a href="#">in general F16L 57/00</a> )}   |
| F22B 37/108 | ....  | {Protection of water tube walls}  |
| F22B 37/12  | ...   | Forms of water tubes, e.g. of varying cross-section   |
| F22B 37/125 | ....  | {Bifurcates}  |
| F22B 37/14  | ...   | Supply mains, e.g. rising mains, down-comers, in connection with water tubes  |
| F22B 37/141 | ....  | {involving vertically-disposed water tubes, e.g. walls built-up from vertical tubes}  |
| F22B 37/142 | ....  | {involving horizontally-or helically-disposed water tubes, e.g. walls built-up from horizontal or helical tubes}  |
| F22B 37/143 | ....  | {Panel shaped heating surfaces built up from tubes ( <a href="#">F22B 37/145</a> takes precedence)}   |
| F22B 37/145 | ....  | {Flag-shaped panels built-up from tubes, e.g. from U-shaped tubes}  |
| F22B 37/146 | ....  | {Tube arrangements for ash hoppers and grates and for combustion chambers of the cyclone or similar type out of the flues}  |
| F22B 37/147 | ....  | {Tube arrangements for cooling orifices, doors and burners}   |
| F22B 37/148 | ....  | {Tube arrangements for the roofs}   |
| F22B 37/16  | ...   | Return bends  |
| F22B 37/165 | ....  | {Closures for access openings in return bends ( <a href="#">boiler plugs for drums or headers F22B 37/223</a> )}  |
| F22B 37/18  | ...   | Inserts, e.g. for receiving deposits from water   |
| F22B 37/20  | ...   | Supporting arrangements, e.g. for securing water-tube sets ( <a href="#">construction of tube walls of furnaces including boiler furnaces F23M 5/08</a> )   |
| F22B 37/201 | ....  | {Suspension and securing arrangements for walls built-up from tubes}  |
| F22B 37/202 | ....  | {Suspension and securing arrangements for contact heating surfaces}   |
| F22B 37/203 | ..... | {Horizontal tubes supported only away from their ends on vertical support tubes}  |
| F22B 37/204 | ....  | {Supporting arrangements for individual tubes, e.g. for securing tubes to a refractory wall}  |
| F22B 37/205 | ....  | {Supporting and spacing arrangements for tubes of a tube bundle}  |
| F22B 37/206 | ..... | {Anti-vibration supports for the bends of U-tube steam generators}  |
| F22B 37/207 | ....  | {Supporting arrangements for drums and collectors}  |
| F22B 37/208 | ....  | {Backstay arrangements}   |
| F22B 37/22  | ..    | Drums; Headers; Accessories therefor ( <a href="#">making boilers from sheet metal B21D 51/24</a> ; <a href="#">pressure vessels in general F16J 12/00</a> ; covers or similar closure members <a href="#">F16J 13/00</a> ) |
| F22B 37/221 | ...   | {Covers for drums, collectors, manholes or the like ( <a href="#">in general F16J 13/00</a> )}  |
| F22B 37/222 | ....  | {Nozzle dams introduced through a smaller manway, e.g. foldable}  |
| F22B 37/223 | ....  | {Boiler plugs, e.g. for handholes ( <a href="#">closures for access openings in return bends F22B 37/165</a> )}   |
| F22B 37/225 | ...   | {Arrangements on drums or collectors for fixing tubes or for connecting collectors to each other}   |

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| F22B 37/226 | ...  | {Protection of drums against combustion}   |
| F22B 37/227 | ...  | {Drums and collectors for mixing}  |
| F22B 37/228 | ...  | {Headers for distributing feedwater into steam generator vessels; Accessories therefor}  |
| F22B 37/24  | ..   | Supporting, suspending, or setting arrangements, e.g. heat shielding ( <a href="#">frames</a> , <a href="#">engine beds F16M</a> )   |
| F22B 37/242 | ...  | {for bottom supported water-tube steam generators}   |
| F22B 37/244 | ...  | {for water-tube steam generators suspended from the top}   |
| F22B 37/246 | ...  | {for steam generators of the reservoir type, e.g. nuclear steam generators}  |
| F22B 37/248 | .... | {with a vertical cylindrical wall}   |
| F22B 37/26  | ..   | Steam-separating arrangements ( <a href="#">vapour-liquid separators</a> , e.g. for drying steam, <a href="#">B01D</a> ; <a href="#">B04</a> )   |
| F22B 37/261 | ...  | {specially adapted for boiler drums}   |
| F22B 37/263 | ...  | {Valves with water separators}   |
| F22B 37/265 | ...  | {Apparatus for washing and purifying steam}  |
| F22B 37/266 | ...  | {Separator reheaters}  |
| F22B 37/268 | ...  | {specially adapted for steam generators of nuclear power plants}   |
| F22B 37/28  | ...  | involving reversal of direction of flow  |
| F22B 37/283 | .... | {specially adapted for boiler drums}   |
| F22B 37/286 | .... | {specially adapted for steam generators of nuclear power plants}   |
| F22B 37/30  | ...  | using impingement against baffle separators  |
| F22B 37/303 | .... | {specially adapted for boiler drums}   |
| F22B 37/306 | .... | {specially adapted for steam generators of nuclear power plants}   |
| F22B 37/32  | ...  | using centrifugal force  |
| F22B 37/322 | .... | {specially adapted for boiler drums}   |
| F22B 37/325 | .... | {using a revolving element}  |
| F22B 37/327 | .... | {specially adapted for steam generators of nuclear power plants}   |
| F22B 37/34  | ..   | Adaptations of boilers for promoting water circulation ( <a href="#">F22B 13/145</a> takes precedence ); <a href="#">auxiliary devices for promoting water circulation F22D 7/00</a> )   |
| F22B 37/36  | ..   | Arrangements for sheathing or casing boilers   |
| F22B 37/365 | ...  | {Casings of metal sheets, e.g. expansion plates, expansible joints}  |
| F22B 37/38  | ..   | Determining or indicating operating conditions in steam boilers, e.g. monitoring direction or rate of water flow through water tubes ( <a href="#">measuring or indicating instruments in general G01</a> )  |
| F22B 37/40  | ..   | Arrangements of partition walls in flues of steam boilers, e.g. built-up from baffles ( <a href="#">in flues or chimneys F23J 13/00</a> )  |
| F22B 37/42  | ..   | Applications, arrangements, or dispositions of alarm or automatic safety devices ( <a href="#">for feed-water heaters F22D 1/14</a> ; <a href="#">emergency feed-water supply F22D 11/003</a> ; <a href="#">alarms responsive to undesired or abnormal conditions G08B</a> ) |
| F22B 37/421 | ...  | {Arrangements for detecting leaks}   |
| F22B 37/423 | ...  | {Valves for testing steam generators}  |
| F22B 37/425 | ...  | {Feed-water supply alarm devices using floats}   |

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| F22B 37/426 | ...  | {Feed-water supply alarm devices using electric signals}   |
| F22B 37/428 | ...  | {Feed-water supply alarm devices using dilatation of solids or liquids}  |
| F22B 37/44  | ...  | of safety valves (safety valves per se <a href="#">F16K</a> )  |
| F22B 37/443 | .... | {Safety devices extinguishing the fire}  |
| F22B 37/446 | .... | {Safety devices responsive to overpressure}  |
| F22B 37/46  | ...  | responsive to low or high water level, e.g. for checking, suppressing, extinguishing combustion in boilers (fire-fighting, fire extinction in general <a href="#">A62</a> )  |
| F22B 37/47  | ...  | responsive to abnormal temperature, e.g. actuated by fusible plugs (such alarms or devices per se <a href="#">G08B</a> )   |
| F22B 37/475 | .... | {Safety devices with fusible plugs}  |
| F22B 37/48  | ..   | Devices for removing water, salt, or sludge from boilers (cleaning internal or external surfaces of water tubes <a href="#">F28G</a> ); Arrangements of cleaning apparatus in boilers (cleaning external surfaces of tubes by soot blowers <a href="#">F23J</a> ); Combinations thereof with boilers |
| F22B 37/483 | ...  | {specially adapted for nuclear steam generators}   |
| F22B 37/486 | ...  | {Devices for removing water, salt, or sludge from boilers ( <a href="#">F22B 37/483</a> , <a href="#">F22B 37/50</a> , <a href="#">F22B 37/52</a> and <a href="#">F22B 37/54</a> take precedence)}   |
| F22B 37/50  | ...  | for draining or expelling water  |
| F22B 37/52  | ...  | Washing-out devices  |
| F22B 37/54  | ...  | De-sludging or blow-down devices {( <a href="#">F22B 37/565</a> takes precedence)}   |
| F22B 37/545 | .... | {Valves specially adapted therefor (valves in general <a href="#">F16K</a> )}  |
| F22B 37/56  | ..   | Boiler cleaning control devices, e.g. for ascertaining proper duration of boiler blow-down   |
| F22B 37/565 | ...  | {Blow-down control, e.g. for ascertaining proper duration of boiler blow-down}   |
| F22B 37/58  | ..   | Removing tubes from headers or drums; Extracting tools   |
| F22B 37/60  | .    | specially adapted for steam boilers of instantaneous or flash type   |
| F22B 37/62  | .    | specially adapted for steam boilers of forced-flow type  |
| F22B 37/64  | ..   | Mounting of, or supporting arrangements for, tube units (construction of tube walls of furnaces, e.g. boiler furnaces <a href="#">F23M 5/08</a> )  |
| F22B 37/645 | ...  | {involving upper vertically-disposed water tubes and lower horizontally- or helically disposed water tubes}  |
| F22B 37/66  | ...  | involving vertically-disposed water tubes ( <a href="#">F22B 37/645</a> takes precedence)  |
| F22B 37/68  | ...  | involving horizontally-disposed water tubes ( <a href="#">F22B 37/645</a> takes precedence)  |
| F22B 37/70  | ..   | Arrangements for distributing water into water tubes   |
| F22B 37/72  | ...  | involving injection devices  |
| F22B 37/74  | ...  | Throttling arrangements for tubes or sets of tubes   |
| F22B 37/76  | .    | Adaptations or mounting of devices for observing existence or direction of fluid flow (devices per se <a href="#">G01P</a> )   |
| F22B 37/78  | .    | Adaptations or mounting of level indicators (level indicators per se <a href="#">G01F</a> )  |