

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](#))

Definition statement

This subclass/group covers:

This subclass covers general aspects of, or methods for, steam generation. Methods of steam generation characterised by the form of heating method, constructional features of steam boilers, control systems for steam boilers and all component parts or details of steam boilers are covered. Thereby this subclass is limited in only methods of, or apparatus for, the generation of steam under pressure for heating or power purposes.

Relationship between large subject matter areas

Steam engine plants where engine aspects predominate are classified in [F01K](#), domestic central heating systems using steam are classified in [F24D](#), heat exchange or heat transfer in general is classified in [F28](#) and the generation of vapour in cores of nuclear reactors is classified in [G21](#).

Informative references

Attention is drawn to the following places, which may be of interest for search:

| | |
|---|------------------------------|
| Cooking vessels | A47J 27/00 |
| Apparatus for making beverages | A47J 31/00 |
| Baking, Roasting, Grilling, Frying | A47J 37/00 |
| Machines for cleaning floors, carpets, furniture, walls, or wall coverings with arrangements for steam generation | A47L 11/4086 |
| Bathing devices for special therapeutic or hygienic purposes | A61H 33/00 |
| Cleaning by methods involving the use or presence of liquid steam | B08B 3/00 |
| Washing machines with steam generation | D06F 39/008 |

| | |
|------------------------------------|----------------------------|
| Hand irons | D06F 75/00 |
| Reciprocating piston steam engines | F01B 17/04 |

Special rules of classification within this subclass

Attention is drawn to the definition of "steam" and "vapour". In cases where a specific entry for vapour is missing, documents related to special vapours are classified in groups where only "steam" is explicitly mentioned.

Glossary of terms

In this subclass/group, the following terms (or expressions) are used with the meaning indicated:

| | |
|----------------------------|---|
| Once through boiler | type of boiler, in which water is input at one side, and steam is extracted from the other side of the flow path |
| Forced flow boiler | Type of boiler, in which a pump ensures flow |
| Forced once through boiler | combination of a once through and a forced flow boiler (a pump ensures flow of a boiler in which water is input at one side, and steam is extracted from the other side of the flow path) |
| Forced circulation boiler | the circulation is achieved by a circulation pump |
| Natural circulation boiler | the circulation is achieved by the difference in density of the heated water in the boiler causing convection currents |

Synonyms and Keywords

In patent documents the following abbreviations are often used:

| | |
|------|-------------------------------------|
| HRSG | Heat Recovery Steam Generator |
| CFCB | Circulated Fluidized Combustion Bed |

| | |
|------|---|
| PFCB | Pressurized Fluidized Combustion Bed |
| AFCB | Atmospheric classic Fluidized Combustion Bed (Bubbling bed) |

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)

Definition statement

This subclass/group covers:

Methods of steam generation

- using combustion of hydrogen with oxygen,
- using solar heat
- by the exploitation of the heat content of hot heat carriers, for example the heat carrier being hot slag, hot residues, or heated blocks of the heat carrier being molten like a molten metal, the heat carrier being hot liquid or hot vapour (i.e. steam), the heat carrier being a hot gas (i.e. waste gas or exhaust gas)
- using heat evolved in a solution absorbing steam like for example soda steam boilers
- using combustion under pressure substantially exceeding atmospheric pressure
- boilers heated electrically

Relationship between large subject matter areas

Use of waste heat of combustion engines, in general, is classified in [F02G](#), solar heat collectors per se in [F24J 2/00](#), Heat pipes in [F28D15/00B](#). When steam is produced and explicitly mentioned as being superheated steam [F22G](#) should be consulted.

References relevant to classification in this group

This subclass/group does not cover:

| | |
|---|---------------------------|
| Methods involving the use of working media other than water, drop in pressure and transforming mechanical energy into heat energy | F22B 3/00 |
|---|---------------------------|

Informative references

Attention is drawn to the following places, which may be of interest for search:

| | |
|---|--|
| Steam power plants using electrical heat | F01K 3/186 |
| Power plants using steam created by combustion of hydrogen with oxygen | F01K 25/005 |
| Devices for producing mechanical power from solar energy | F03G 6/00 |
| Solar power plants | F03G7/02 |
| Production of supercritical steam | F22G , F22B 3/08 |
| Superheating using an electrical heat source independent from heat supply of the steam boiler | F22G 1/165 |
| Heat exchangers having a liquid metal as heat exchange medium | F28D7/00C |

F22B 3/00

Other methods of steam generation; Steam boilers not provided for in other groups of this subclass

Definition statement

This subclass/group covers:

This covers all other methods of steam generation and steam boilers, which are not covered by the group [F22B 1/00](#). These methods of steam generation and steam boilers include involving working media other than water, steam generation by drop in pressure of high-pressure hot water within pressure reducing chambers, by transformation of mechanical (kinetic) energy into heat energy and steam generation at critical or supercritical pressure values.

Relationship between large subject matter areas

Methods for superheating steam are classified in [F22G](#)

References relevant to classification in this group

This subclass/group does not cover:

| | |
|---|---------------------------|
| All other "conventional" steam generation methods | F22B 1/00 |
|---|---------------------------|

Informative references

Attention is drawn to the following places, which may be of interest for search:

| | |
|---|----------------------------|
| Plants characterised by the use of special working fluids | F01K 25/00 |
|---|----------------------------|

F22B 5/00

Steam boilers of drum type, i.e. without internal furnace or fire tubes, the boiler body being contacted externally by flue gas

Definition statement

This subclass/group covers:

Steam boilers containing a closed vessel designed to withstand internal pressure for generating steam. The drum is contacted externally by flue gases. The group also covers old documents with big rotating drums, documents with auxiliary water tubes outside the boiler body and components and accessories of the drum.

Relationship between large subject matter areas

Covers or similar closure members are classified in [F16J 13/00](#)

Informative references

Attention is drawn to the following places, which may be of interest for search:

| | |
|--|----------------------------|
| Instantaneous boiler with rotating heat exchange elements | F22B 27/12 |
| Steam generation plants with a boiler of furnace tube type and a boiler of | F22B 33/04 |

| | |
|-----------------|--|
| water tube type | |
|-----------------|--|

F22B 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

Definition statement

This subclass/group covers:

Boilers in which combustion of fuel is performed inside one or more furnace-tubes running through a sealed container of water. Combustion heat is transferred through the walls of the tubes by thermal conduction, thereby heating water and creating steam. The group also covers steam boilers of furnace-tube type with auxiliary water tubes inside the furnace tube and outside the boiler body, with auxiliary fire tubes and component parts of the boiler, like for example walling of flues. Components and accessories of the furnace-tubes itself are classified in [F22B 37/06](#).

Relationship between large subject matter areas

The following types of steam boilers are covered by the following classification schemes:

- Steam boilers of drum type are classified in [F22B 5/00](#).
- Steam boilers of fire-tube type are classified in [F22B 9/00](#).
- Steam boilers of combined fire-tube type and water-tube type are classified in [F22B 11/00](#).
- Steam boilers of fire box type are classified in [F22B 13/00](#).
- Steam boilers of water-tube type are classified in [F22B 15/00](#), [F22B 17/00](#), [F22B 19/00](#) and [F22B 23/00](#).

References relevant to classification in this group

This subclass/group does not cover:

| | |
|---|----------------------------|
| Accessories of the flue or the furnace-tubes itself | F22B 37/06 |
|---|----------------------------|

Informative references

Attention is drawn to the following places, which may be of interest for search:

| | |
|--|----------------------------|
| Steam generation plants comprising boilers of water-tube type in mutual association with a boiler of furnace-tube type | F22B 33/04 |
| Steam generation plants comprising boilers of furnace-tube type in mutual association with a boiler of fire-tube type | F22B 33/06 |
| Auxiliary devices for promoting water circulation fitted to furnace tubes | F22D 7/02 |

Special rules of classification within this group

Steam boilers with drums having a furnace tube or a furnace box also in combination with drums contacted externally with flue gases should be classified in [F22B 7/00](#) and [F22B 13/005](#). This applies also to boilers with special shape of furnace tube and subsequent flue.

F22B 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

Definition statement

This subclass/group covers:

Boilers in which hot flue gases from a combustion chamber outside the boiler body said body being a sealed container, are channelled through tubes built-in the boiler body that are surrounded by the fluid to be heated. Heat of the gases is transferred through the walls of the tubes by thermal conduction, heating the water and creating steam. This group covers also arrangements of the fire-tubes and the boiler as well as components of the boiler itself.

Relationship between large subject matter areas

The following types of steam boilers are covered by the following classification schemes:

- Steam boilers of drum type are classified in [F22B 5/00](#).
- Steam boilers of furnace-tube type are classified in [F22B 7/00](#).

- Steam boilers of combined fire-tube type and water-tube type are classified in [F22B 11/00](#).
- Steam boilers of fire box type are classified in [F22B 13/00](#).
- Steam boilers of water-tube type are classified in [F22B 15/00](#), [F22B 17/00](#), [F22B 19/00](#) and [F22B 23/00](#).

References relevant to classification in this group

This subclass/group does not cover:

| | |
|--|----------------------------|
| Accessories of the flue or the fire-tubes itself, like fire tube inserts | F22B 37/06 |
|--|----------------------------|

Informative references

Attention is drawn to the following places, which may be of interest for search:

| | |
|---|-----------------------------|
| Methods of steam generation with heating tubes in which flows a non-specified heating fluid | F22B 1/021 |
| Methods of steam generation with hit gas heating tube boilers with one or more heating tubes | F22B 1/1884 |
| Steam generation plants comprising boilers of furnace-tube type in mutual association with a boiler of fire-tube type | F22B 33/06 |
| Steam generation plants comprising boilers of water tube-type in mutual association with a boiler of fire-tube type | F22B 33/08 |

Special rules of classification within this group

In this group boilers which are mainly of fire-tube type are classified. If the boiler contains also water tubes, the boiler is considered of being a combined fire-tube and water-tube boiler. Concerned documents should be classified in [F22B 11/00](#).

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

Definition statement

This subclass/group covers:

All combinations of the steam boilers of fire-tube type with steam boilers of water-tube type consisting of a fire-tube boiler with auxiliary water tubes or a water-tube boiler having auxiliary fire-tubes in a water or steam containing vessel. This group covers also boilers with fire-tubes being in upright and horizontal arrangement.

Relationship between large subject matter areas

The following types of steam boilers are covered by the following classification schemes:

- Steam boilers of drum type are classified in [F22B 5/00](#).
- Steam boilers of furnace-tube type are classified in [F22B 7/00](#).
- Steam boilers of fire-tube type are classified in [F22B 9/00](#).
- Steam boilers of fire box type are classified in [F22B 13/00](#).
- Steam boilers of water-tube type are classified in [F22B 15/00](#), [F22B 17/00](#), [F22B 19/00](#) and [F22B 23/00](#).

Informative references

Attention is drawn to the following places, which may be of interest for search:

| | |
|--|---|
| Steam boilers of fire box-type with flues other than fire tubes and with auxiliary water tubes inside the fire box | F22B 13/023 , F22B 13/026 |
| Steam boilers of drum type with auxiliary water tubes outside the boiler body. | F22B 5/02 |
| Steam boilers of furnace-type with auxiliary fire-tubes and auxiliary water tubes | F22B 7/14 |
| Steam boilers of furnace-type with auxiliary water tubes. | F22B 7/04 , F22B 7/06 , F22B 7/08 , F22B 7/10 |
| Steam boilers of furnace-type with | F22B 7/12 |

| | |
|---|---|
| auxiliary fire tubes | |
| Steam boilers of fire box-type with auxiliary water tubes inside the fire box | F22B 13/10 , F22B 13/12 |

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

Definition statement

This subclass/group covers:

Boilers in which combustion of fuel is performed inside a chamber called fire box and fire tubes of flues being attached to the wall of the fire-box and carry the hot gaseous products of combustion through the boiler water, heating it, before they escape to the atmosphere. Both, the fire-box and fire-tubes are built-in in the boiler body. This group covers locomotive boilers, fire-box boiler with flues other than fire-tubes and component parts of said boilers.

Relationship between large subject matter areas

The following types of steam boilers are covered by the following classification schemes:

- Steam boilers of drum type are classified in [F22B 5/00](#).
- Steam boilers of furnace-tube type are classified in [F22B 7/00](#)
- Steam boilers of fire-tube type are classified in [F22B 9/00](#).
- Steam boilers of combined fire-tube type and water-tube type are classified in [F22B 11/00](#).
- Steam boilers of water-tube type are classified in [F22B 15/00](#), [F22B 17/00](#), [F22B 19/00](#) and [F22B 23/00](#).

References relevant to classification in this group

This subclass/group does not cover:

| | |
|--|----------------------------|
| Accessories of the flue or the fire-tubes itself, like fire tube inserts | F22B 37/06 |
|--|----------------------------|

Informative references

Attention is drawn to the following places, which may be of interest for search:

| | |
|--|------------------------------|
| Modifications of boiler construction with combustion in a fluidized bed for boilers of shell type (furnace-box) | F22B 31/0046 |
| Modifications of boiler construction with combustion in a fluidized bed for boilers of shell type (furnace-box) with auxiliary water tubes | F22B 31/0053 |
| Steam generation plants comprising boilers of water-tube type in mutual association with a boiler of furnace-tube type | F22B 33/04 |
| Steam generation plants comprising boilers of furnace-tube type in mutual association with a boiler of fire-tube type | F22B 33/06 |
| Water heaters with water mantle surrounding the combustion chamber including one or more furnace or fire tubes | F24H 1/282 |

F22B 15/00

Water-tube boilers of horizontal type, i.e. the water-tube sets being arranged horizontally

Definition statement

This subclass/group covers:

Details and constructional features of water tube boiler in which water circulates in tubes heated externally and characterised by strictly horizontal arranged water tubes or water tube walls. If the water tube sets are inclined slightly with respect to the horizontal plane, than group [F22B 17/00](#) should be considered.

Relationship between large subject matter areas

The following other types of steam boilers are covered by the following classification schemes:

- Steam boilers of drum type are classified in [F22B 5/00](#).
- Steam boilers of furnace-tube type are classified in [F22B 7/00](#)
- Steam boilers of fire-tube type are classified in [F22B 9/00](#).
- Steam boilers of combined fire-tube type and water-tube type are classified in [F22B 11/00](#).
- Steam boilers of fire box type are classified in [F22B 13/00](#).

References relevant to classification in this group

This subclass/group does not cover:

| | |
|--|----------------------------|
| Water-tube boilers with water tube sets being inclined slightly with respect to the horizontal plane | F22B 17/00 |
|--|----------------------------|

Informative references

Attention is drawn to the following places, which may be of interest for search:

| | |
|--|----------------------------|
| Water tube boilers of horizontally-inclined type | F22B 17/00 |
| Water tube boilers of combined horizontally-inclined type and vertical type | F22B 19/00 |
| Water tube boilers of vertical or steeply-inclined type | F22B 21/00 |
| Water tube boilers built up from sets of spaced double-walled water tubes | F22B 23/00 |
| Water tube boilers built up from sets of water tubes with internally arranged flue tubes or fire tubes | F22B 25/00 |
| Fluid heaters with water tube or tubes | F24H 1/40 |

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

Definition statement

This subclass/group covers:

Details, constructional features and component parts of water tube boilers in which water circulates in tubes heated externally and characterised by horizontally-inclined water tubes or water tube walls.

Relationship between large subject matter areas

If the water tube sets are inclined horizontally, then group [F22B 15/00](#) should be considered.

The following other types of steam boilers are covered by the following classification schemes:

- Steam boilers of drum type are classified in [F22B 5/00](#).
- Steam boilers of furnace-tube type are classified in [F22B 7/00](#)
- Steam boilers of fire-tube type are classified in [F22B 9/00](#).
- Steam boilers of combined fire-tube type and water-tube type are classified in [F22B 11/00](#).
- Steam boilers of fire box type are classified in [F22B 13/00](#).

References relevant to classification in this group

This subclass/group does not cover:

| | |
|--|----------------------------|
| Water-tube boilers with water tube sets being arranged strictly horizontally | F22B 15/00 |
|--|----------------------------|

Informative references

Attention is drawn to the following places, which may be of interest for search:

| | |
|--|----------------------------|
| Water-tube boilers of horizontal type | F22B 15/00 |
| Water tube boilers of combined horizontally-inclined type and vertical | F22B 19/00 |

| | |
|--|----------------------------|
| type | |
| Water tube boilers of vertical or steeply-inclined type | F22B 21/00 |
| Water tube boilers built up from sets of spaced double-walled water tubes | F22B 23/00 |
| Water tube boilers built up from sets of water tubes with internally arranged flue tubes or fire tubes | F22B 25/00 |
| Fluid heaters with water tube or tubes | F24H 1/40 |

F22B 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

Definition statement

This subclass/group covers:

Details, constructional features and component parts of water tube boilers in which water circulates in tubes heated externally and characterised by horizontally inclined water tube sets being connected to or having also an auxiliary water tube set with vertical or substantially vertical water tubes.

Relationship between large subject matter areas

The following other types of steam boilers are covered by the following classification schemes:

- Steam boilers of drum type are classified in [F22B 5/00](#).
- Steam boilers of furnace-tube type are classified in [F22B 7/00](#)
- Steam boilers of fire-tube type are classified in [F22B 9/00](#).
- Steam boilers of combined fire-tube type and water-tube type are classified in [F22B 11/00](#).
- Steam boilers of fire box type are classified in [F22B 13/00](#).

Informative references

Attention is drawn to the following places, which may be of interest for search:

| | |
|--|----------------------------|
| Water-tube boilers of horizontal type | F22B 15/00 |
| Water tube boilers of horizontally-inclined type | F22B 17/00 |
| Water tube boilers of vertical or steeply-inclined type | F22B 21/00 |
| Water tube boilers built up from sets of spaced double-walled water tubes | F22B 23/00 |
| Water tube boilers built up from sets of water tubes with internally arranged flue tubes or fire tubes | F22B 25/00 |
| Fluid heaters with water tube or tubes | F24H 1/40 |

F22B 21/00

Water-tube boilers of vertical or steeply-inclined type, i.e. the water-tube sets being arranged vertically or substantially vertically

Definition statement

This subclass/group covers:

Details, constructional features and component parts of water tube boilers in which water circulates in tubes heated externally and characterised by vertically or substantially vertically water tubes or water tube walls. This group covers straight water tubes and serpentine, helical bent in U-loop or spirally formed water tubes disposed vertically.

Relationship between large subject matter areas

The following other types of steam boilers are covered by the following classification schemes:

- Steam boilers of drum type are classified in [F22B 5/00](#).
- Steam boilers of furnace-tube type are classified in [F22B 7/00](#)
- Steam boilers of fire-tube type are classified in [F22B 9/00](#).

- Steam boilers of combined fire-tube type and water-tube type are classified in [F22B 11/00](#).
- Steam boilers of fire box type are classified in [F22B 13/00](#).

Informative references

Attention is drawn to the following places, which may be of interest for search:

| | |
|--|----------------------------|
| Water-tube boilers of horizontal type | F22B 15/00 |
| Water tube boilers of horizontally-inclined type | F22B 17/00 |
| Water tube boilers of combined horizontally-inclined type and vertical type | F22B 19/00 |
| Water tube boilers built up from sets of spaced double-walled water tubes | F22B 23/00 |
| Water tube boilers built up from sets of water tubes with internally arranged flue tubes or fire tubes | F22B 25/00 |
| Fluid heaters with water tube or tubes | F24H 1/40 |

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

Definition statement

This subclass/group covers:

Details, constructional features and component parts of water tube boilers in which water circulates in tubes heated externally and characterised by sets of spaced double-walled water tubes of return type in unilateral abutting connection with a boiler drum or with a header box forming for example an annular flow.

Relationship between large subject matter areas

The following other types of steam boilers are covered by the following classification schemes:

- Steam boilers of drum type are classified in [F22B 5/00](#).
- Steam boilers of furnace-tube type are classified in [F22B 7/00](#)
- Steam boilers of fire-tube type are classified in [F22B 9/00](#).
- Steam boilers of combined fire-tube type and water-tube type are classified in [F22B 11/00](#).
- Steam boilers of fire box type are classified in [F22B 13/00](#).

Informative references

Attention is drawn to the following places, which may be of interest for search:

| | |
|--|----------------------------|
| Water-tube boilers of horizontal type | F22B 15/00 |
| Water tube boilers of horizontally-inclined type | F22B 17/00 |
| Water tube boilers of combined horizontally-inclined type and vertical type | F22B 19/00 |
| Water tube boilers of vertical or steeply-inclined type | F22B 21/00 |
| Water tube boilers built up from sets of water tubes with internally arranged flue tubes or fire tubes | F22B 25/00 |
| Fluid heaters with water tube or tubes | F24H 1/40 |
| Steam superheaters with steam tubes with steam flowing in opposite directions in one pipe | F22G 3/004 |
| Steam superheaters with steam tubes with annular steam tubes | F22G 3/005 |

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

Definition statement

This subclass/group covers:

Details, constructional features and component parts of water tube boilers in which water circulates in tubes heated externally and characterised by sets of water tubes with internally arranged flue tubes or fire tubes forming thereby an annular flow of the water to be evaporated.

Relationship between large subject matter areas

The following other types of steam boilers are covered by the following classification schemes:

- Steam boilers of drum type are classified in [F22B 5/00](#).
- Steam boilers of furnace-tube type are classified in [F22B 7/00](#)
- Steam boilers of fire-tube type are classified in [F22B 9/00](#).
- Steam boilers of combined fire-tube type and water-tube type are classified in [F22B 11/00](#).

Steam boilers of fire box type are classified in [F22B 13/00](#).

Informative references

Attention is drawn to the following places, which may be of interest for search:

| | |
|---|----------------------------|
| Water-tube boilers of horizontal type | F22B 15/00 |
| Water tube boilers of horizontally-inclined type | F22B 17/00 |
| Water tube boilers of combined horizontally-inclined type and vertical type | F22B 19/00 |
| Water tube boilers of vertical or steeply-inclined type | F22B 21/00 |
| Water tube boilers built up from sets of spaced double-walled water tubes | F22B 23/00 |
| Fluid heaters with water tube or tubes | F24H 1/40 |
| Steam superheaters with steam tubes | F22G 3/004 |

| | |
|--|----------------------------|
| with steam flowing in opposite directions in one pipe | |
| Steam superheaters with steam tubes with annular steam tubes | F22G 3/005 |

F22B 27/00

Instantaneous or flash steam boilers

Definition statement

This subclass/group covers:

All steam generators and steam generation methods with an instant steam generation process including flash steam boilers. The group covers instantaneous steam boilers built up from fire tubes, from water tubes, from rotary heat-exchange elements or from heat-exchange elements arranged within a confined chamber having heat retaining walls and steam boilers with spray nozzles for sprinkling or injecting water particles on to or into hot heat-exchange elements.

Informative references

Attention is drawn to the following places, which may be of interest for search:

| | |
|---|-----------------------------|
| Component parts or details of steam boilers specially adapted for steam boilers of instantaneous or flash type | F22B 37/60 |
| Instantaneous electrical steam generators built up from heat exchange elements arranged within a confined chamber having heat retaining walls | F22B 1/288 |
| Control systems for instantaneous steam generators | F22B 35/005 |
| Water tube boiler of vertical type with water tubes bent in serpentine or sinuous form | F22B 21/24 |
| Water tube boiler of vertical type with water tubes bent helically | F22B 21/26 |
| Water tube boiler of vertical type with | F22B 21/28 |

| | |
|--|----------------------------|
| water tubes bent spirally | |
| Steam boiler of drum type with rotating drums | F22B 5/005 |
| Steam generation using heat accumulators | F22B 1/028 |
| Steam engine plants with steam generation in engine-cylinders | F01K 21/02 |
| Steam boilers heated electrically with water in sprays or in films | F22B 1/287 |

F22B 29/00

Steam boilers of forced-flow type

Definition statement

This subclass/group covers:

Steam boilers in which means are provided, such a pump in order to ensure the flow of the working medium. The group covers details, component parts and arrangements of steam boilers of forced circulation type, steam boilers of combination type in which natural flow (convection circulation) is promoted by additional measures and boilers of once through type in which flow is forced (forced once through boilers).

Relationship between large subject matter areas

Water tube boilers of horizontal type ([F22B 15/00](#)) are normally steam boilers of forced flow type and Water tube boilers of vertical type ([F22B 21/00](#)) are normally boilers of natural convection type.

Informative references

Attention is drawn to the following places, which may be of interest for search:

| | |
|---|----------------------------|
| Steam plants with engines using steam of critical or supercritical pressure | F01K 7/32 |
| Water tube boilers of vertical type with water tubes bent helically | F22B 21/26 |
| Water tube boilers of vertical type | F22B 21/28 |

| | |
|---|---|
| with water tubes bent spirally | |
| Steam boilers built up from water tubes surrounding the combustion chamber (radiation boilers) | F22B 21/34 |
| Steam generation at critical or supercritical pressure values | F22B 3/08 |
| Steam generation plants with combinations of boilers having a single combustor in common | F22B 33/00 |
| Control systems of steam boilers with natural convection circulation | F22B 35/02 |
| Supply means for steam boilers with vertically and horizontally or helically disposed water tubes | F22B 37/141 , F22B 37/142 |
| Details and component parts specially adapted for boilers of forced flow type | F22B 37/62 |
| Details of boilers of forced flow type with vertically disposed water tubes | F22B 37/66 |
| Details of boilers of forced flow type with horizontally disposed water tubes | F22B 37/68 |
| Devices for promoting water circulation in preheaters by injecting water or steam | F22D 7/04 |

Special rules of classification within this subgroup

In subgroup [F22B 29/06](#) steam boilers of once through type are classified. Even it is not explicitly mentioned said subgroup covers forced once through boilers.

Glossary of terms

In this subclass/group, the following terms (or expressions) are used with the meaning indicated:

| | |
|---------------------|---|
| Once through boiler | type of boiler, in which water is input at one side, and steam is extracted |
|---------------------|---|

| | |
|----------------------------|---|
| | from the other side of the flow path |
| Forced flow boiler | type of boiler, in which a pump ensures flow |
| Forced once through boiler | combination of a once through and a forced flow boiler (a pump ensures flow of a boiler in which water is input at one side, and steam is extracted from the other side of the flow path) |
| Forced circulation boiler | the circulation is achieved by a circulation pump |
| Natural circulation boiler | the circulation is achieved by the difference in density of the heated water in the boiler causing convection currents |

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)

Definition statement

This subclass/group covers:

Modifications of boiler construction or of tube systems dependent on the installation of combustion apparatus like

- boilers with combustion in a fluidized bed (boilers of water tube type, constructional features of bed cooling, control systems thereof, details concerning the recirculation of the fluidized bed particles)
- installation of water tube boilers in chimneys
- heat supply by installation of two or more combustion apparatus and
- installations of heat exchangers in boilers for heating air supplied for combustion

Relationship between large subject matter areas

Chemical or physical processes in general, conducted in the presence of fluids and solid particles and apparatus for such processes are covered by [B01J 8/00](#). Fluidized bed combustion apparatus per se are covered by group [F23C 10/00](#) and fluidised bed furnaces by group [F27B 15/00](#).

Informative references

Attention is drawn to the following places, which may be of interest for search:

| | |
|---|-----------------------------|
| Steam engine plants having heaters using heat from a specified chemical reaction | F01K 3/188 |
| Plants in which combustion heat from one cycle is heating the fluid in the other cycle and where the combustion is performed in a fluidised bed | F01K 23/061 |
| Steam engine plants having heaters with heating by separately fired heaters | F01K 3/24 |
| Waste heat boiler with supplementary firing, the hot gas being loaded with particles | F22B 1/1876 |
| Feed water heaters with water and air preheating systems | F22D 1/36 |
| Steam superheaters using heat generated by chemical reactions | F22G 1/14 |
| Heating of air supplied for combustion | F23L 15/00 |
| Heat exchange apparatus using a fluidised bed | F28D 13/00 |

Synonyms and Keywords

In this subclass/group, the following terms (or expressions) are used with the meaning indicated:

In patent documents the following abbreviations are often used:

| | |
|------|---------------------------|
| FBC | Fluidized Bed Combustion |
| PFBC | Pressurised Fluidized Bed |

| | |
|--------|--|
| | Combustion |
| APFBC | Advanced Pressurised Fluidized Bed Combustion |
| GFBC | Gasification Fluidized Bed Combustion Combined cycle systems |
| CHIPPS | Combustion-based High Performance Power System |

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](#))

Definition statement

This subclass/group covers:

Steam generation plants in the meaning of devices for the generation of steam with other apparatus in mutual association with the steam boilers. Steam boilers of different types in mutual association having a single combustion apparatus in common, like combinations

- of boilers of furnace tube type with boilers of water tube type
- of boilers of furnace tube type with boilers of fire tube type
- of boilers of water tube type with boilers of fire tube type
- of two or more superposed boilers,

self contained boilers comprising as a unit the steam boiler, the combustor and fuel storage accessory machines,

combinations of low and high pressure boilers and

combinations of steam boilers with other apparatus, like a condenser, a chemical reactor or other are also covered.

Relationship between large subject matter areas

Steam engine plants related to the thermodynamic cycle and focussed in power generation are classified in [F01K](#).

The following types of steam boilers are covered by the following classification schemes:

- Steam boilers of drum type are classified in [F22B 5/00](#).
- Steam boilers of furnace-tube type are classified in [F22B 7/00](#).
- Steam boilers of fire tube type are classified in [F22B 9/00](#).
- Steam boilers of combined fire-tube type and water-tube type are classified in [F22B 11/00](#).
- Steam boilers of fire box type are classified in [F22B 13/00](#).
- Steam boilers of water-tube type are classified in [F22B 15/00](#), [F22B 17/00](#), [F22B 19/00](#) and [F22B 23/00](#).

Informative references

Attention is drawn to the following places, which may be of interest for search:

| | |
|---|-----------------------------|
| Arrangements or dispositions of steam-generation plants in marine vessels | B63H 21/00 |
| Steam engine plants having separately fired heaters delivering steam to a common mains | F01K 3/242 |
| Steam engine plants having separately fired heaters delivering steam at different pressure levels | F01K 3/245 |
| Steam boilers of fire box type with combinations of low and high pressure locomotive boilers | F22B 13/065 |

Special rules of classification within this group

Documents which contain a boiler of combined water tube and fire tube type should be classified in [F22B 11/00](#). Subgroup [F22B 33/08](#) covers steam generation plants comprising several boilers having a single combustion apparatus in common where at least one boiler is a boiler of water tube type and at least another is a boiler of fire tube type.

F22B 35/00

Control systems for steam boilers ([N: 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)

Definition statement

This subclass/group covers:

Control system of steam boilers in general like control by flue gas dampers, control by recirculating flue gases, control systems for steam generators of nuclear power plants, control systems for instantaneous steam boilers, control systems for waste heat boilers, control systems for two or more steam generators, control systems for steam boilers with natural convection circulation and control systems for steam boilers of forced flow type.

Relationship between large subject matter areas

Documents related to control of nuclear power plants are classified in [G21D 3/00](#), to control of nuclear reaction in [G21C 7/00](#), control of steam engine plants in [F01K 13/02](#), to control of feed water heaters in [F22D 5/00](#) and control of superheat temperature in [F22G 5/00](#).

Informative references

Attention is drawn to the following places, which may be of interest for search:

| | |
|---|------------------------------|
| Regulation or control of steam power plants | F01K 7/00 |
| Steam boilers of once through type operating with superimposed recirculation during starting and low load periods | F22B 29/12 |
| Control systems for for fluidized bed boilers | F22B 31/0076 |
| Safety devices for boilers in general | F22B 37/42 |
| Emergency feed water supply | F22D 11/003 |
| Controlling water feed or level with electric switches for feeding a number of steam boilers | F22D 5/36 |
| Control superheat temperature by regulating flue gas flow | F22G 5/04 |

| | |
|---|---------------------------|
| Control superheat temperature by recirculating flue gases | F22G 5/06 |
| Control superheat temperature by attemperating the superheated steam | F22G 5/12 |
| Control superheat temperature by indirectly cooling or heating the superheated steam in auxiliary enclosed heat exchanger | F22G 5/16 |
| Control of combustion | F23N |
| Regulating or controlling in general | G05 |

Glossary of terms

In this subclass/group, the following terms (or expressions) are used with the meaning indicated:

| | |
|----------------------------|---|
| Once through boiler | type of boiler, in which water is input at one side, and steam is extracted from the other side of the flow path |
| Forced flow boiler | Type of boiler, in which a pump ensures flow |
| Forced once through boiler | combination of a once through and a forced flow boiler (a pump ensures flow of a boiler in which water is input at one side, and steam is extracted from the other side of the flow path) |
| Forced circulation boiler | the circulation is achieved by a circulation pump |
| Natural circulation boiler | the circulation is achieved by the difference in density of the heated water in the boiler causing convection currents |

F22B 37/00

Component parts or details of steam boilers (venting devices [F16K 24/00](#); steam traps or like apparatus [F16T](#))

Definition statement

This subclass/group covers:

Component parts or details of steam boilers categorised in three groups:

- of steam generators built up from pre fabricated elements
- of nuclear steam generators including maintenance or repairing
- applicable to more than one kind of steam boiler
- specially adapted for steam boilers of instantaneous or flash type
- specially adapted for steam boilers of forced flow type
- adaptations or mounting of devices for observing existence or direction of fluid flow
- adaptations or mounting of level indicators

The group, which is applicable to more than one kind of steam boiler and which could be applied also to nuclear steam boilers, steam boilers of pre fabricated elements, instantaneous type boilers and forced flow type boilers, covers:

- steam boilers characterised by material
- accessories of flue or fire tubes
- accessories of water tubes
- accessories of drums or headers
- arrangements for supporting, suspending or setting
- steam separating arrangements
- adaptation of boilers for promoting water circulation
- arrangements for sheathing or casing boilers
- devices and methods for determining or indicating operation conditions
- arrangements of partition walls in flues of steam boilers
- applications of alarm or automatic safety devices
- devices and methods for removing water, salt or sludge

- boiler cleaning control devices
- methods and tools for removing tubes from headers or drums

Relationship between large subject matter areas

Working or processing of sheet metal or metal tubes are classified in [B21D](#), pipes, joints and fittings for pipes in [F16L](#) and cleaning of internal or external surfaces of heat exchangers in [F28D](#).

Informative references

Attention is drawn to the following places, which may be of interest for search:

| | |
|--|-----------------------------|
| Venting devices | F16K 24/00 |
| Devices for use where pipes pass through walls or partitions | F16L 5/00 |
| Devices for covering leaks in pipes or hoses | F16L 55/16 |
| Protection of tubes against external or internal damage or wear | F16L 57/00 |
| Steam traps or like apparatus | F16T |
| Steam generator using hot slag, hot residues with double wall tubes | F22B 1/066 |
| Vertical water tube boilers with frames built from water tubes | F22B 21/086 |
| Component parts of water tubes surrounding the combustion chamber | F22B 21/38 |
| Furnace tubes of furnace tube type boilers | F22B 7/20 |
| Radiant superheaters | F22G 1/06 |
| Connecting or sealing of superheater or reheater tubes with collectors or distributors | F22G 3/009 |
| Baffles, screens or deflectors formed of water tubes | F23M 9/10 |

| | |
|--|-----------------------------|
| Details for water heaters | F24H 9/0036 |
| Arrangements for sealing leaky tubes and conduits of heat exchangers | F28F 11/00 |
| Surface treatment or coating for heat exchangers | F28F 13/18 |
| Preventing the formation of deposits or corrosion from heat exchangers | F28F 19/00 |
| Decontamination of radioactive contaminated objects | G21F 9/001 |