

**CPC****COOPERATIVE PATENT CLASSIFICATION****F22D**

**PREHEATING, OR ACCUMULATING PREHEATED, FEED-WATER; FEED-WATER SUPPLY; CONTROLLING WATER LEVEL; AUXILIARY DEVICES FOR PROMOTING WATER CIRCULATION WITHIN BOILERS** (chemical treatment of water, e.g. purification, [C02F](#) ; enclosed heat-exchange apparatus in general [F28D](#) ; controlling in general [G05](#))

**F22D 1/00**

**Feed-water heaters, i.e. economisers or like preheaters**

**F22D 1/003**

. {Feed-water heater systems ([F22D 1/325](#), [F22D 1/36](#) and [F22D 1/40](#) take precedence)}

**F22D 1/006**

. {with heating tubes ([F22D 1/24](#) takes precedence)}

**F22D 1/02**

. with water tubes arranged in the boiler furnace, fire tubes, or flue ways (heat-exchange tubes in general [F28F](#))

**F22D 1/04**

.. the tubes having plain outer surfaces, e.g. in vertical arrangement

**F22D 1/06**

... in horizontal arrangement

**F22D 1/08**

.. the tubes having fins, ribs, gills, corrugations, or the like on their outer surfaces, e.g. in vertical arrangement

**F22D 1/10**

... in horizontal arrangement (hollow fire-bars, grates, or the like used as water tubes [F23H 3/02](#))

**F22D 1/12**

.. Control devices, e.g. for regulating steam temperature

**F22D 1/14**

.. Safety or venting devices (safety devices for boilers in general [F22B 37/42](#))

**F22D 1/16**

. with water tubes arranged otherwise than in the boiler furnace, fire tubes, or flue ways

**F22D 1/18**

.. and heated indirectly

**F22D 1/20**

.. and directly connected to boilers

**F22D 1/22**

.. and provided for rotary movements

**F22D 1/24**

. with fire tubes or flue ways traversing feed-water vessels

**F22D 1/26**

. with means, other than tubes, to separate water and heating medium, e.g. bulk heaters without internal flues or tubes, jacketed smoke-boxes or flue or flues

**F22D 1/28**

. for direct heat transfer, e.g. by mixing water and steam

**F22D 1/30**

.. with stages, steps, baffles, dishes, circular troughs, or other means to cause interrupted or cascading fall of water (de-aeration apparatus [C02F](#))

**F22D 1/32**

. arranged to be heated by steam, e.g. bled from turbines

**F22D 1/325**

.. {Schematic arrangements or control devices therefor}

**F22D 1/34**

.. and returning condensate to boiler with main feed supply

**F22D 1/36**

. Water and air preheating systems

**F22D 1/38**

.. Constructional features of water and air preheating systems

**F22D 1/40**

. Combinations of exhaust-steam and smoke-gas preheaters (for locomotives [F22D 1/42](#))

**F22D 1/42**

. specially adapted for locomotives

**F22D 1/44**

.. Smoke-gas preheaters

**F22D 1/46**

.. Exhaust-steam preheaters

- F22D 1/48 . . Details
- F22D 1/50 . incorporating thermal de-aeration of feed-water (de-aeration produced in the course of direct heat transfer [F22D 1/28](#); thermal de-aeration of water per se [B01D 19/00](#), [C02F 1/20](#); valves for venting [F16K 24/04](#))
  
- F22D 3/00** **Accumulators for preheated water**
- F22D 3/02 . arranged within combustion chambers
- F22D 3/04 . combined with steam accumulators
- F22D 3/06 . directly connected to boilers
- F22D 3/08 . specially adapted for locomotives (locomotives boilers [F22B 13/06](#))
- F22D 3/10 . . Control devices (controlling water feed to boilers, or water level [F22D 5/00](#))
  
- F22D 5/00** **Controlling water feed or water level; Automatic water feeding or water-level regulators** (steam traps [F16T](#); measuring or indicating instruments [G01](#); for indicating water level [G01F](#); level control in general [G05D 9/00](#))
- F22D 5/02 . with an intermediate compartment from which the water is fed by gravity after mechanically moving the compartment, the movement being controlled according to water level
- F22D 5/04 . with pivoting buckets
- F22D 5/06 . with receptacles external to, but in free communication with, the boilers and adapted to move up and down in accordance with change in water level
- F22D 5/08 . with float-actuated valves
- F22D 5/10 . . and with pistons or membranes unitary with the feed inlet valves
- F22D 5/12 . . and with dipping tubes
- F22D 5/14 . responsive to thermal expansion and contraction, e.g. of solid elements
- F22D 5/16 . . of fluids
- F22D 5/18 . for varying the speed or delivery pressure of feed pumps
- F22D 5/20 . . without floats
- F22D 5/22 . . with floats
- F22D 5/24 . with electric switches
- F22D 5/26 . Automatic feed-control systems (automatic safety devices [F22B 37/42](#); controlling in general [G05](#))
- F22D 5/28 . . responsive to amount of steam withdrawn; responsive to steam pressure
- F22D 5/30 . . responsive to both water level and amount of steam withdrawn or steam pressure
- F22D 5/32 . . influencing the speed or delivery pressure of the feed pumps
- F22D 5/34 . . Applications of valves (valves per se [F16K](#))
- F22D 5/36 . . for feeding a number of steam boilers designed for different ranges of temperature and pressure
  
- F22D 7/00** **Auxiliary devices for promoting water circulation** (adaptation of boilers for promoting water circulation [F22B 37/34](#))
- F22D 7/02 . Saddles or like directing plates fitted to furnace tubes
- F22D 7/04 . Injectors for water or steam
- F22D 7/06 . Rotary devices, e.g. propellers

- F22D 7/08 . . Arrangements of pumps, e.g. outside the boilers
- F22D 7/10 . . . within the boilers
- F22D 7/12 . Control devices
- F22D 7/14 . specially adapted for locomotive boilers
  
- F22D 11/00** **Feed-water supply not provided for in other main groups**
- F22D 11/003 . {Emergency feed-water supply (safety devices for boilers in general [F22B 37/42](#))}
- F22D 11/006 . {Arrangements of feedwater cleaning with a boiler}
- F22D 11/02 . Arrangements of feed-water pumps ([F22D 11/06](#) takes precedence; pumps per se [F04](#))
- F22D 11/04 . . with means to eliminate steam formation
- F22D 11/06 . . for returning condensate to boiler