

**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

[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